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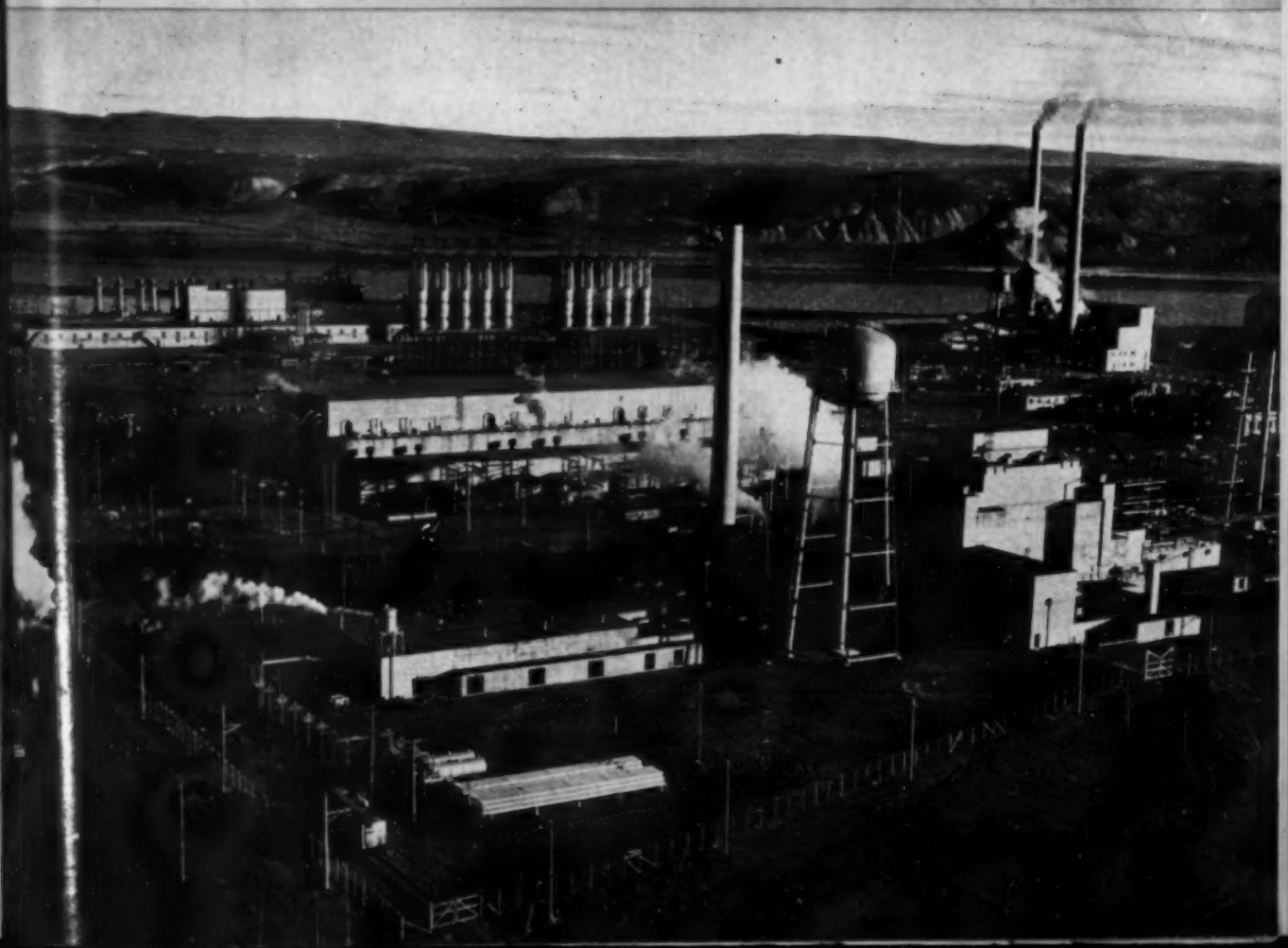
For SEPTEMBER, 1945 • **CHEM. & MET. EDITORS REPORT ON VISITS TO OAK RIDGE AND HANFORD ATOMIC ENERGY PLANTS • INTEGRATION OF CHEMICAL PLANT FACILITIES IS EXEMPLIFIED IN ETHYL CELLULOSE PRODUCTION AT HOPEWELL, VA. • PROBLEMS INVOLVED WHEN DEALING WITH SURPLUS PROPERTY OFFICERS ARE NUMEROUS**

One of the large production units at the atomic energy plant near Richland, Wash.



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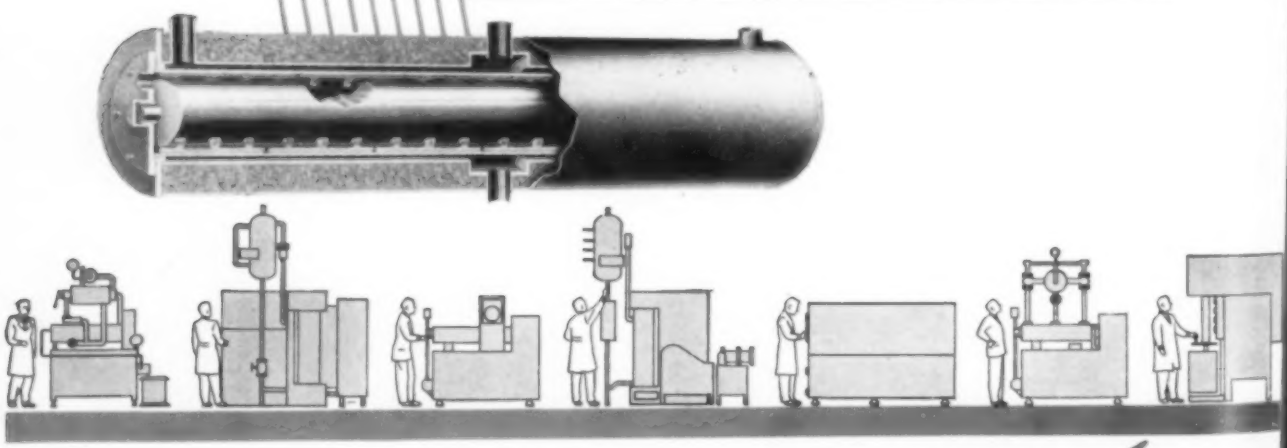

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CHEMICAL & Metallurgical ENGINEERING

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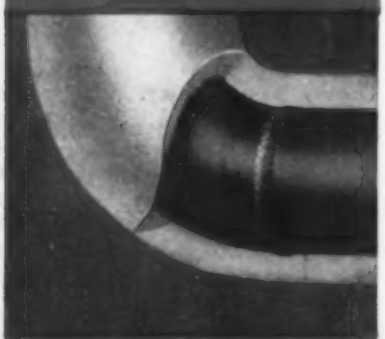

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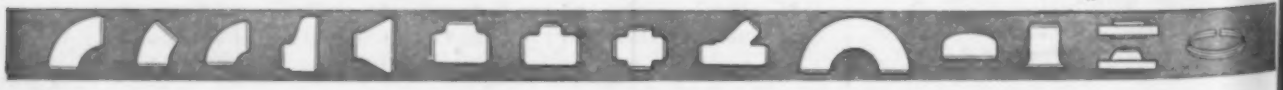

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WATCHING WASHINGTON

R. S. McBRIDE, Editorial Consultant • PAUL WOOTON, Chief of McGraw-Hill Washington Bureau • J. V. HIGHTOWER, Washington Correspondent

Tin expected to remain tight into 1946 . . . Anti-trust armistice is over . . . Data about Jap's chemical industry are available for the asking . . . Patent committee discloses basic subjects on which it is working . . . Senate proposes establishment of Research Board for National Security . . . Only two ammonia plants operated under Ordnance contracts remain in action . . . Controls over many chemicals are dropped . . . Plans for management of chemical enterprises in Germany are taking shape . . . Director appointed to centralize and expedite publication of technical data developed during the war . . . Chile established new lower rates of duty on chemicals.

BOTTLENECK ITEMS

DESPITE heavy military cutbacks and increased availability of materials in general, WPB emphasizes the need for continued reclaiming and reuse of natural rubber, tin, fats and oils. The short supplies of these materials are among the possible bottlenecks to reconversion.

Little is known of the condition of foreign facilities which must be used to bring out the tin and rubber from the Pacific. Tin is expected to remain tight into 1946. The tire industry will quickly absorb early increases in rubber imports. Fats and oils, says the Department of Agriculture, will probably remain short the rest of this year because of low inventories and expected small imports resulting from the world shortage. Relief in the present tight supply situation of soap fats depends largely on the rate at which imports of Philippine copra are increased.

PROTEIN FROM RED NUTS

DEPARTMENT of Agriculture says its Southern Research Laboratory has developed a simple process for decolorizing red peanut skins by washing the nuts with a dilute lye solution. Processing cost is $2 per ton handled. Protein made from the nut meal is practically free of the pigments originally present in the skins and is suitable for spinning fibers and making cold-glue, paper coatings and cold water paints.

ANTI-TRUST ARMISTICE ENDS

THE ANTI-TRUST armistice, declared early in the war to avoid frightening industry, is over. Attorney General Clark has promised early action on postponed cases. He made this statement a day after being informed by the War and Navy Departments that ". . . all requests (for delays of anti-trust proceedings) heretofore made by the War Department and the Navy Department are withdrawn, and that the agreement in question may be considered to be terminated." The agreement was the anti-trust armistice.

This action releases 25 cases to the Department of Justice for prosecution. Among the group are seven cases of interest to the chemical industries, as the suits involve dyestuffs, pharmaceuticals, methanol, tungsten carbide and stainless steel.

THE JAPS' INDUSTRIES

AMERICAN authorities charting the economic future of Japan have a large fund of information about the Japs' chemical and metallurgical industries. In Washington the Department of the Interior is rounding into shape a mass of facts collected by the department and other federal agencies. This will show the nature and extent of Nippon's metals, minerals, coal, synthetic fuels and chemical process industries.

The Japs were short of such critical materials as petroleum, ferrous metals, copper, lead, tin, mercury, bauxite and an understanding of America. However, the devastation they wrought in Asia showed what a ruthless power can do, unless curbed, with a network of modern chemical plants. Synthetics industries, freeing nations from dependence on natural materials, are to be particularly watched.

THE HABIT OF LEANING

AMONG immediate postwar problems confronting industry is the reconversion of a wartime mentality that for four years has looked to Washington for the solution of difficulties. A high official in WPB warns, "Industry has long been in the habit of leaning on government. It must recognize that although troubles will follow in a free economy, facing troubles is better than facing permanent control." There are groups within and outside the government who would tolerate or welcome continuation of the dependent attitude. Responsible men in Washington have this in mind as they stress the need of closing out federal war agencies without undue delay.

PATENT GROUP ASKS VIEWS

THE PRESIDENT'S Committee on the Patent System, after a late start, has disclosed the basic subjects on which it has begun to work. These are: Necessary action to prevent the issue of patents that are not for true inventions; necessary action to make patent protection more simple and effective; means of preventing the abuse of patent rights; examination of the patent system in the light of its objectives.

The public is asked to express to Secretary of Commerce Wallace its views on these subjects. Manufacturers, inventors and technologists cannot afford to ignore the committee's activities. Congress may be called to take a hand. Included in the committee's agenda is the question as to how far Congress may have to intervene in patent procedure and organization of the Patent Office.

This means that industry must not only express its views to the committee but must keep an eye on Congress. Any ill-advised changes that were made in the patent system could defeat its purposes and seriously discourage invention and the application of invention.

MILLERS SHY OF CORN

CORN REFINERS' representatives in Washington say millers are praying for a late fall in order to get out of the woods. Because of the late planting of the current crop and heavy feeding of corn by farmers, some wet grinders had to suspend operations at times during the summer. Their grinding in August was only about 75 percent of the July volume.

The feeling in the Department of Agriculture is that the current crop may approach 2,900,000,000 bu., but only if the frost comes late. An appreciable percentage may have to go to silage and feeding rather than to the mills. It also seems likely that War Foods Order 141 restrain-

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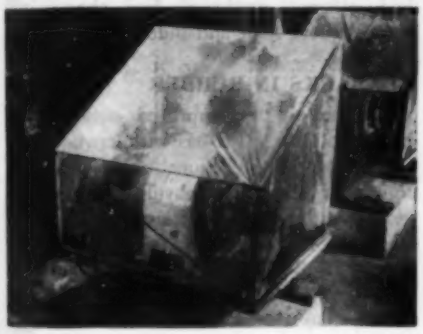

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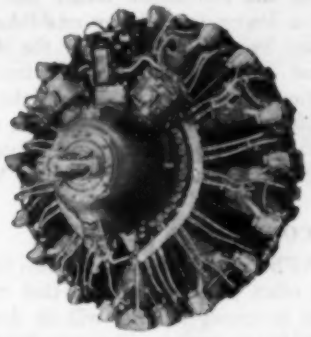

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ing corn from distillers and exporters will remain in force well into the year.

HIGH-OCTANE STORY

For the first time the Petroleum Administration for War has disclosed the peak production of 100-octane aviation gasoline. In July it reached the all-time high of 530,000 bbl. per day in American refineries. This compares with a daily output of 50,000 bbl. at the time of Pearl Harbor. The achievement represents an investment approaching $1 billion, of which the major share was private capital.

The highly competitive petroleum industry cooperated to an unprecedented degree in pooling raw materials, brains and facilities to make the achievement possible. As a result of the aviation gasoline program the petroleum refining industry is today using chemical processing more than ever before in the forms of catalytic cracking, hydroforming, polymerization, alkylation, hydrogenation, dehydrogenation, cyclization and isomerization.

MILITARY RESEARCH PLANNED

Earliest legislative action on postwar research programs of the government is likely to result in the Senate where the Byrd bill is pending. That measure proposes the establishment of a Research Board for National Security, which would "formulate programs of scientific research and development relative to problems of national security," and otherwise serve Army, Navy, and the President as research advisor.

A bill of this general sort passed the House in the form of H.R. 3,440; but it is objected to because it puts the responsibility and funds under the direction of the National Academy of Sciences. The Byrd measure S. 825 establishes the Research Board within the general governmental framework and makes it an active collaborator of Army and Navy. This is much preferred by the military departments and is likely to be the policy adopted.

Some have anticipated that the Byrd bill might have to wait until a National Research Foundation was set up under a combination of Bush and Kilgore committee plans. Such delay is criticized by the Naval Affairs Committee of the Senate, which recommends that the pending measure be promptly enacted, and adds: "If at a later date, it is found desirable to create a National Research Foundation, the Board created by the present bill could be placed under and be made a part of such foundation."

OBSERVE SURPLUS LAW!

President Truman speaking through John Snyder, the reconversion boss, has announced that surplus property sales will be made within the terms of the present Surplus Property Act. If that law proves a serious obstacle to business dealings, as expected by all of Washington, then the President intends to ask Congress to amend the law so that it will be workable. Meantime negotiations which assume that the law can be ignored or evaded are not going to get very far.

Most important result of this policy appears to be a need for leases on properties to cover the interval during which purchase negotiations are conducted by industry and sales arrangements made by officials with Congressional and Justice Department permission. Quick sales are not likely except when a firm exercises outright its option to buy in some existing contract.

NITROGEN CHANGE-OVER

The reconversion needs for nitrogen were assessed by an inter-departmental committee working with the War Department even before Jap surrender terms were accepted. Thus one of the earliest actions of the War Department in the hectic victory week was to order the shutting down of all but two synthetic ammonia plants which were being operated under Ordnance Department contracts.

It is reported that the two arsenals at Baxter Springs, Kan., and Eldorado, Ark., were selected for continued operation because their production of synthetic ammonia and ammonium nitrate had been at the lowest cost of any establishments owned by and operated for the Army. These establishments were ordered to continue operations to supply the ammonia needed for fertilizer purposes under plans similar to the ammonia allocations program previously administered by WPB.

RECONVERSION SPEEDED

WPB's program for reconversion follows the often repeated promise that regulations governing industry will be dropped as swiftly as possible. Chairman Krug outlined in considerable detail the sweeping steps by which all phases of industry are emerging from Washington's dominance, the broad principles being as follows:

1. Reduction of the priority network to a skeleton following transition from the AA system and CMP on September 30 to ratings to protect only military and emergency civilian needs. Ratings will still be used sparingly to help break bottlenecks and meet special export requirements.

2. Revocation of practically all *E*, *L*, *M*, *P*, *R* and *U* orders to simplify the order structure. Where shortages still exist, regulations will continue temporarily.

3. Elimination of most distribution controls. Regulations will be retained on the few items still rationed and in a few borderline cases involving forest products, chemicals and containers.

4. Slashing of manpower controls. WPB will continue, however, to certify to the War Manpower Commission such areas as might still suffer from manpower shortages.

INVENTORY CHECKS REMAIN

Authority over inventories has not been scrapped by WPB. Power over inventories will be kept as insurance that civilian production is not impeded by needless stockpiling and pre-emptive buying of scarce materials. Crude rubber and tin exemplify these items. WPB has notified its field offices to make spot checks of inventories in war plants in order to be certain that war contract cancellations are followed promptly by cancellations and unrating of materials orders.

CHEMICAL CONTROLS FADE

WPB has dropped or is about to drop controls over many chemicals to facilitate the free movement of materials. Sharp cutbacks in military demand, as well as recent improvements in supply in some instances, account for the relaxations.

Among chemicals scheduled to be freed from WPB control on September 30 were the following: natural resins, nitrogen compounds, peroxygen chemicals, potash, pyrethrum, primary chromium chemicals, rotenone, phthalic anhydride and synthetic ammonia. The dwindling list over which control might continue for a while includes cinchona bark and cinchona alkaloid, ethanol, methanol, lead chemicals, rosin, tapioca flour and hide glue stock.

CUTBACKS IN RUBBER

In view of the improved outlook for natural rubber WPB has withdrawn sponsorship of four additional mills in California for processing guayule shrub. Harvesting and processing of guayule will continue but no new plantings will be made, says WPB. The Department of Agriculture will continue to operate two mills in California, one at Salinas and the other at Bakersfield.

The Chemicals Bureau of WPB moved late in August to cancel three projects intended to increase production of channel black. Two of these were federally financed expansion projects which were to have been operated by Cabot Carbon Co. at Eunice, N. M., and by the Jefferson Lake Sulphur Co. at Clemons, Tex. The third undertaking was a projected pipeline, also federally financed, for G. E. Johnson, Stonewall, Okla.

FILE CLAIMS PROMPTLY

The Office of Contract Settlement urges that war contractors with terminations file their claims at once. That agency says, "To avoid having industry's funds tied up during the critical reconversion period, provision for interim financing was made by regulations issued by this office. The latest surveys disclose that ample

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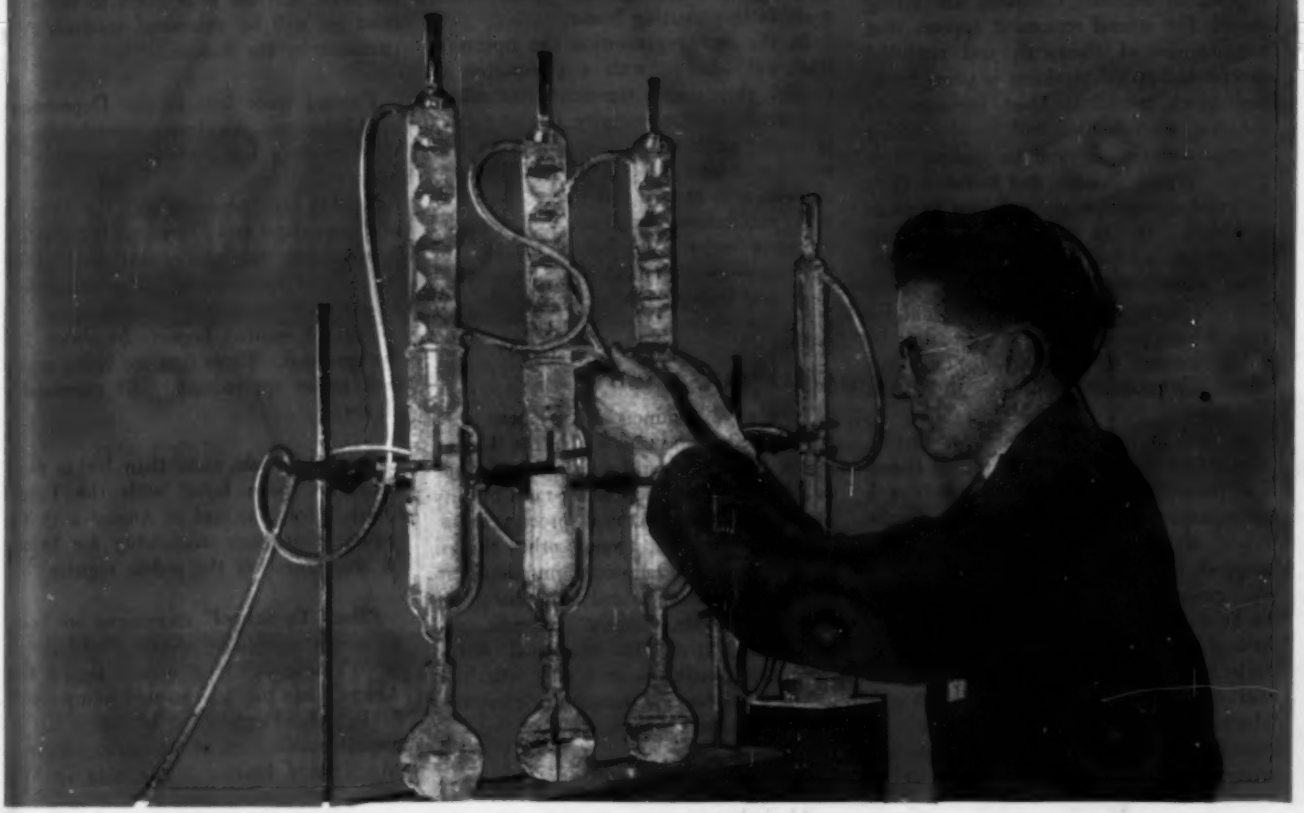

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funds are available to finance contractors with terminations either through partial payments or guaranteed T-loans."

NO NAZI CHEMICALS?

Plans for management of chemical enterprise in defeated Germany are taking shape. For several reasons it appears that manufacture of chemicals and chemical process industries' products is going to be very much curtailed. Most important in stopping manufacture will be the taking as reparations equipment for making these goods. France, Britain, and Russia in their zones of occupation are stripping factories ruthlessly. In the American zone some taking of equipment is expected. But more important in prospect seems to be Russia's desire to buy for herself and for Poland equipment that would not be worth moving to the United States but which can profitably be moved to Eastern Europe.

Second in imminence, perhaps first in importance, is the consideration that chemical manufacture will be regarded as a continuance of military effort. Thus many types of chemical processing will be stopped by the forces of occupation on the ground that they might contribute to later German preparedness. Thus the best guess in Washington currently seems to be that very little chemical manufacture will continue in Germany even though plants may be undamaged or easily repaired and raw materials may soon be available.

SCIENTIFIC DATA RELEASE

Moving to centralize and expedite publication of the mass of technical and scientific data developed during the war by the allied and enemy governments, President Truman has vested the director of war mobilization and reconversion with supervision over the entire task. Truman arranged this by modifying executive order 9568 to enable the director to supervise the declassification of data from enemy sources in addition to allied government information.

The direction has, in effect, placed the "operating" end of the work in the Department of Commerce by establishing an operating staff of Department of Commerce men to hasten preparation and declassification of the information. The Secretary of Commerce heads the staff. Executive secretary of the staff is J. C. Green, room 1319, Department of Commerce Building, Washington, D. C. To him should be sent requests for information.

A meeting was held a few weeks ago to begin correlating the task of the new organization with the work hitherto performed by such individual groups as the Joint Committee on Scientific Information Policy and the Enemy Technical Reports Committee.

President Truman's action followed a flood of requests from industry for information. There has been some delay in putting the technical and scientific data into shape for publication and declassifying the data. One difficulty has been that these functions were in the hands of different government agencies which lacked a satisfactory clearing house.

In the new organization the operating staff will consult with a committee of various government representatives which will weigh military security against factors justifying publication. The operating staff will then render an opinion to the Director of War, who in turn will receive the views of a publication board established under executive order 9568 before making the final recommendation to the Secretaries of War and Navy. These individuals will make the ultimate decision.

CHILE CUTS TARIFFS

In a new commercial agreement with the United States, in which the United States made no tariff concessions, Chile established certain new lower rates of duty on products of chemical process industries. These affect, among other things: Tannic acid and tannin; ammonium carbonate, bicarbonate, and phosphate; potassium chlorate, impure chloride, and liquid silicate; certain medicinal sirups, granulated medicines and pills; clarifying powders; gelatin; and numerous items made of Bakelite and other like plastics.

MINOR NEWS GLIMPSES

Alcohol prices were fixed by OPA for early postwar control at 80c. per gal. Eastern manufacturers of industrial alcohol will be embarrassed by this ceiling if they cannot get molasses. The freight on grain squeezes out any profit when operating under this price limit, thus some of these Eastern producers argued when trying to get the ceiling lifted.

Arsenical insecticides are being carried over from this season in large quantities because there have been no serious insect infestations of cotton during 1945, for the second successive year. Anyone else who wants white arsenic can have it in generous quantities.

Tin controls must be continued until Malayan tin can move smoothly and regularly through available smelters to the United States. Tin substitutes for the automobile industry will be used extensively and tin for food containers will be limited. No one can yet guess in what quarter of 1946 the tin supply may prove to be enough to escape those serious limitations.

Helium production plants of the Bureau of Mines had been closed down at Cunningham, Kan., and Amarillo, Tex., even before V-J Day. It was expected that the plants at Exell, Tex., and Otis, Kan., would be continued. But even that much helium is no longer needed; and final postwar plans must contemplate further curtailment of the Bureau of Mines' helium business. Anyone who wants to buy that inert gas will be welcomed cordially as a customer by the Bureau.

Foreign trade lists of the Department of Commerce are being completely revised to show the postwar distribution of industry. American firms wanting this information can cooperate with the Division of Commercial and Economic Information in planning for new trade lists giving names and addresses of all potential purchasers of American merchandise or sources of wanted imports in about 100 foreign areas. These lists are being organized under approximately 85 commodity classes.

Patents for sale, more than 300 in number, have been listed with the Patent Office before the end of August with the request that their availability for license be announced on the public register.

"Back To School" campaigns are being vigorously pressed by several official groups of Washington. It is widely argued that America has too few trained brains in all fields. The Department of Labor has an extended campaign of general significance. Much more limited is the plan of War Manpower Commission seeking to put at least 12,000 young men and women into medical, dental, pre-medic, and pre-dental class work this Fall. In some cases the efforts give promise, even if only moderately successful in having more applicants for college work than can be accommodated by the recognized schools.

Salvage programs will be pressed for some months for waste paper, tin cans, and kitchen fats. Users of these commodities are urged to cooperate lest the letdown at the end of the war cause collapse in the salvage campaign.

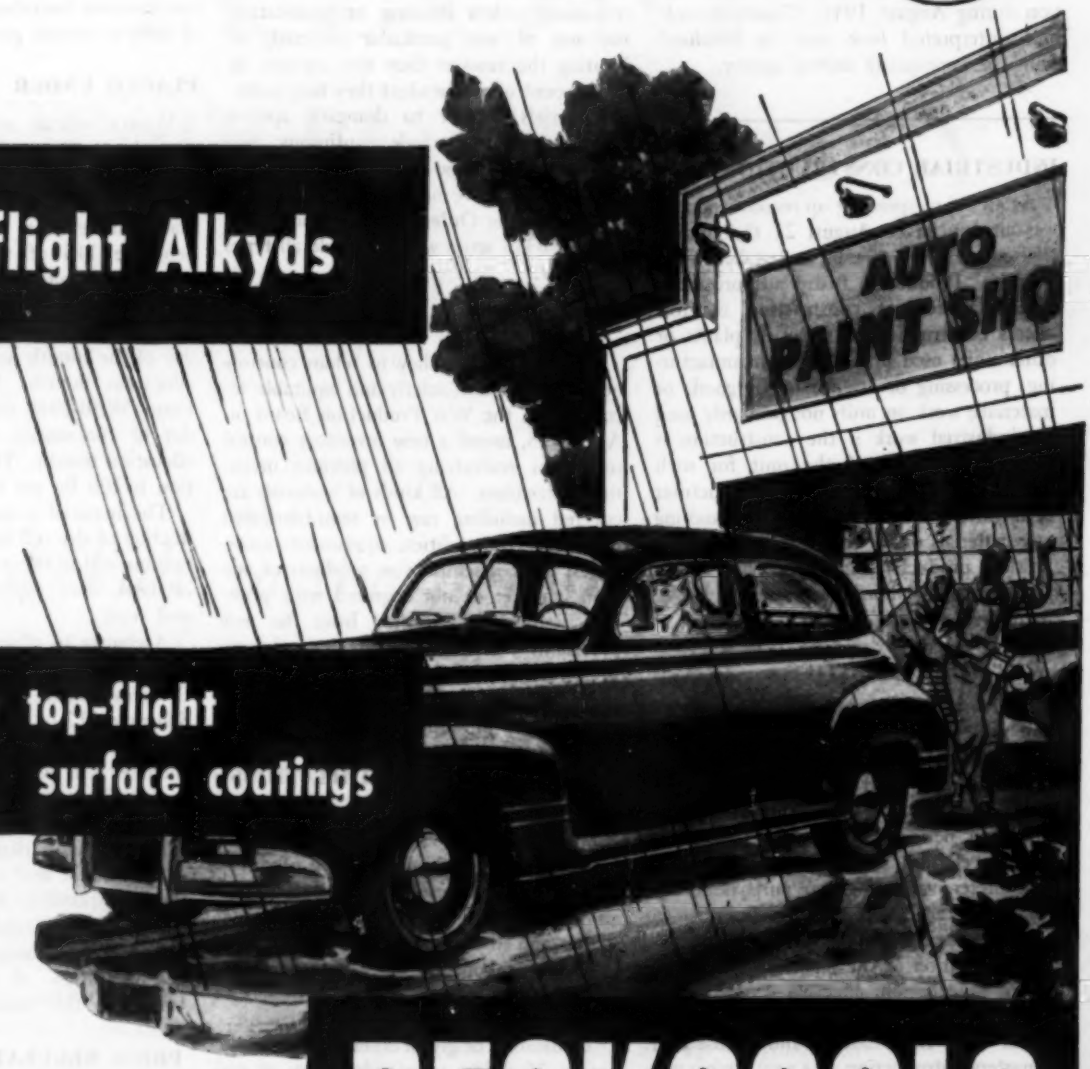
Penicillin certification has been authorized by a congressional amendment of the Food and Drug Law. It is now illegal to offer for sale any compound wholly or in part of penicillin unless the batch from which it comes has been officially certified by actual test of Food and Drug Administration.

Pricing rules of comparatively simple form have been prepared to govern both commercial pricing and the sale of government surplus property. If anyone questions the propriety of prices quoted he can, so says OPA, quickly test the legality by these "readily understandable price formulas."

WORLD'S LARGEST PRODUCER OF SYNTHETIC RESINS

RCI

Top-flight Alkyds



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SYNTHETIC RESINS • CHEMICAL COLORS • INDUSTRIAL PLASTICS • INDUSTRIAL CHEMICALS

INTERPRETATIONS

This installment covers orders, rules and regulations issued by the War Production Board and the Office of Price Administration during August, 1945. Copies of each item interpreted here may be obtained from the appropriate federal agency.

INDUSTRIAL CONSTRUCTION

As an aid to speeding up reconversion, it was announced on August 21 that industrial construction may be undertaken without War Production Board authorization. The relaxation of construction controls affects construction of factories, plants or other units used primarily for manufacturing, processing or assembling of goods or materials; work on units not primarily used for industrial work if the construction is to prepare a part of the unit for such work; and construction by a manufacturer of facilities that are necessary for handling raw materials or for the distribution of his finished products. Pilot plants and industrial research laboratories are specifically mentioned as coming under this ruling.

WARTIME PRIORITIES

Action has been taken to eliminate by the end of September the old wartime priorities system including the Controlled Materials Plan and to substitute a new, limited system for use during the reconstruction period. This action resulted in the cancellation, effective August 22, of all AA preference ratings on purchase orders that call for delivery after September 30 (the AA ratings will still apply to textiles); the revocation of the Controlled Materials Plan; cancellation, effective August 22, of all allotments of steel, copper, and aluminum for the fourth and subsequent quarters; introduction of a new junior, non-extensible, civilian CC preferenced rating to be used in limited cases to break bottlenecks in reconversion and insure, when necessary, continued production and services. It is expected that almost all materials will either be in surplus or in comfortable supply and that ratings will therefore generally not be needed.

SURPLUS MATERIALS

On August 22, restrictions were removed on special sales of most, but not all, idle, excess and surplus materials. Special sales are those made by persons who acquired or made the materials for use and not for sale or resale. All sales of surpluses by government agencies also are special sales. Nearly all materials in contract termination inventories and government surplus may now be sold freely and may be used for any permitted civilian production. However, special sales of certain scarce materials are still restricted. Moreover, buyers may not use materials acquired under Priorities Regulation 13 in violation of any of the remaining orders limiting or prohibiting the use of any particular material, or limiting the amount they may receive, or the amount of any product they may make.

Materials subject to domestic special sales restrictions include: antimony, pig tin, uranium, rope and cordage fibers (manila and agave only), textile materials obtained under Order M-328B, and orders in the M-338 series which include all types of rubber.

INVENTORY CONTROLS

As part of its policy to retain controls necessary to assist orderly and equitable reconversion, the War Production Board on August 28, issued a new inventory control regulation embodying all previous inventory restrictions. All kinds of materials are covered including raw or semi-fabricated materials, commodities, equipment, accessories, parts, assemblies or products of any kind whether or not acquired with priorities assistance. Excepted from the new provisions is a list of materials in ample supply. This list will be expanded as soon as more materials and components are determined to be in ample supply.

ALLOCATIONS AND LIMITATIONS

The end of the war has brought a sharp drop in military requirements for a wide line of raw materials and finished products. This in turn has resulted in the revocation or modification of numerous allocation orders and in many limiting orders.

Dyestuff controls have been relaxed which makes it possible for consumers to increase their color quotas for civilian use.

Consumers of glycol ethers may purchase up to 25 drums upon submission of end use certificates. The small order exemption for monoethyl ether of ethylene glycol was reduced from 4,100 lb. to 2,050 lb. a month.

Laundries and dry-cleaning establishments using any of the three chlorinated solvents, carbon tetrachloride, trichlorethylene and perchlorethylene have been free of controls since August 31.

Allocation controls for arsenic have been lifted because there is an adequate supply available in the Western Hemisphere. In addition shipping lanes to Sweden have been opened and Sweden is the world's largest producer of arsenic.

Silica gel and desiccant grade bentonite are no longer under allocation because military demands have fallen to a point where stocks are ample. The desiccant grade of bentonite was developed as a wartime measure to supplement the supply of silica gel.

Penicillin now has no restrictions on its use and distribution. At the same time WPB freed chrome chemicals; dropped allocation controls on natural resins and the two insecticides rotenone and pyrethrum; revoked an order controlling the distribution of coke; and through its Rubber Bureau removed limitations on the production of tires in certain groups.

PLACED UNDER ALLOCATION

While official action last month in general was directed toward freeing materials from controls, white ammonium chloride offered an exception as it was placed under the allocation controls of Schedule 116 of the general chemicals order. The initial allocation date was set for September 1. Suppliers are required to file Form WPB-2946 on or before the 20th day of the month preceding the requested allocation month. Consumers must file Form WPB-2945 on or before the 15th day of the month before the requested allocation month. The small order exemption is 200 lb. per user per month.

The material is used chiefly in the production of dry cell batteries, also in leather tanning and in the production of adhesives, catalysts, dyes, explosives, pharmaceuticals and yeast.

A change in allocation control is found in the case of naphthenic acid and naphthenates which have been transferred to Schedule 117 of M-300. Only naphthenic acid will be allocated as control of naphthenates will be maintained through end use certificates. The definition of naphthenates was revised to include any mixture containing more than 10 percent by weight of naphthenic acid instead of the 5 percent formerly specified. Mixtures containing less than 20 percent naphthenic acid combined as copper naphthenate were excluded from the definition of naphthenates as controlled by the schedule.

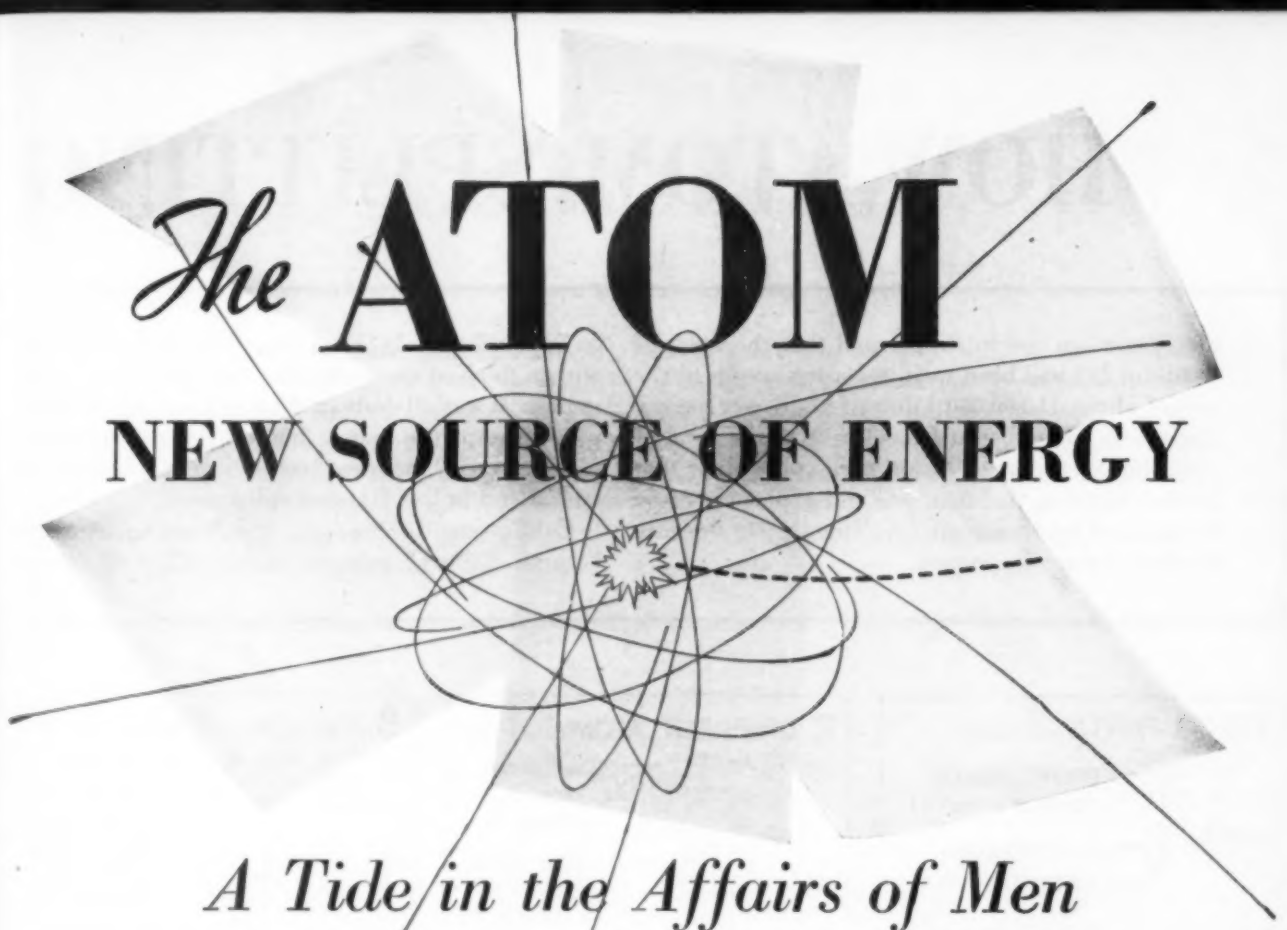
PRICE REGULATIONS

An increase of $1.20 per net ton in northeastern producers' ceiling prices for building, chemical and industrial lime, excluding agricultural lime, was granted by the Office of Price Administration, effective August 13. The increase applies to sales in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut and eastern New York.

Imported stearic acid has been given ceilings which, with all duties and taxes paid, bring it in line with the ceilings which prevail for equivalent grades and quantities of domestic stearic acid.

Both producers and resellers of gum rosin have been granted price increases amounting to 95c. per 100 lb. The rise was granted to maintain and increase the supply of this critically short material. However, it was granted on a tentative basis and is subject to review in a period of from 60 to 90 days.

The ATOM
NEW SOURCE OF ENERGY



A Tide in the Affairs of Men

On August 6, 1945, an atomic bomb exploded over the Japanese city, Hiroshima.

Its concussion blasted the city, vaporized the fibre of Japan's will to resist, and flashed across the world a light of such glaring intensity that even blind eyes could glimpse the forked road that is presented to humanity's choice and destiny.

It has been a scant fifty years since Pierre and Marie Curie embarked upon their research with the avowed intent of discovering "how the atoms of the universe are put together". Their work contributed radium to the knowledge and use of mankind, but it marked only a way station upon the awesome quest which they announced and which thousands of scientists have since pursued.

Under the compelling stimulus of war, the first major application of the release of atomic force has been in an instrument that raises by an unimaginable dimension our ability to dole out death. We can be devoutly grateful that the scientific leadership of the Allies, and particularly the industrial strength of the United States, brought to us, rather than to our enemies, priority in the development of this dread weapon. But even in its present infant phase, it is clear that ownership of the principle of the atomic bomb carries a trusteeship of terrifying gravity.

We hold in trust a power that is capable of unraveling the very fabric of our civilization. Equally, it may be susceptible of development as a mighty force for human welfare. But we have proved the destructive use, while the constructive applications are still in the realm of speculation.

Clearly the trust is of a magnitude that transcends national jurisdiction. No walls have ever been built high enough to fence in the spread of scientific knowledge, and even if we were resolved to forego the harnessing of atomic power for peace, it is hopeless to think that its application for war can be held for long as the monopoly of one, or a small group of nations.

At one giant stride our scientific and technological development has so far outdistanced our social engineering, that we have no choice but to turn our full powers of creative imagination to control the forces we have unleashed and to bend them to man's use rather than to his destruction.

Since control is not possible without understanding, I have asked several of my editorial colleagues in the McGraw-Hill organization to present on the pages which follow a non-technical but authoritative account of the known facts and implications of atomic power.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

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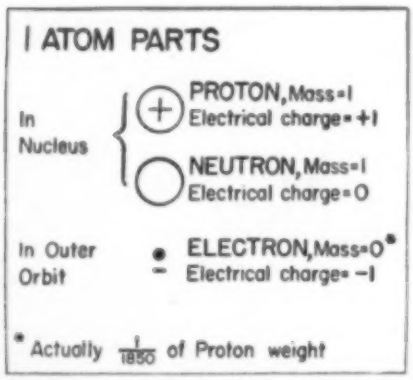
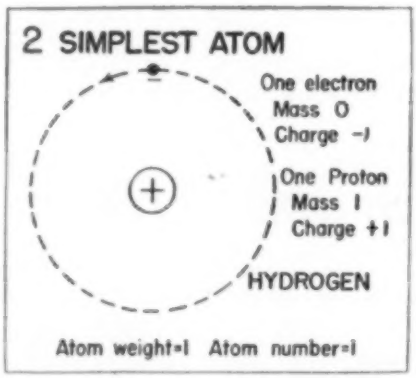
HOW ATOM SPLITTING

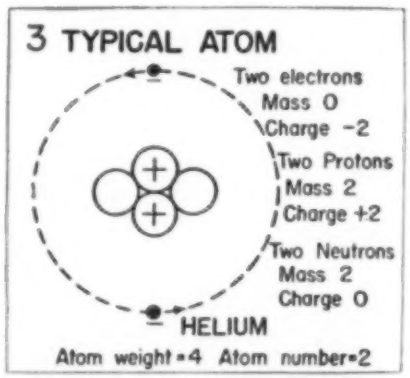
Five years ago the world learned that the atom of Uranium 235 had been split, releasing energy at the rate of about 11,400,000 kilowatt-hours per pound. The whole amount tested was less than the head of a pin, but there was no escaping the possibility that heaters, engines, turbines, jets and explosives could be powered by atomic energy. Then began the race to win the war with atoms.

With what help England could give, America outran the best atom-splitting team Germany could muster. It was all done in silence. From the summer of 1940 until the atomic bomb blasted Hiroshima, black secrecy blanketed history's most amazing scientific and industrial accomplishment.

Coldly scientific in form, the War Department's "Smyth Report," released August 12, 1945, traces

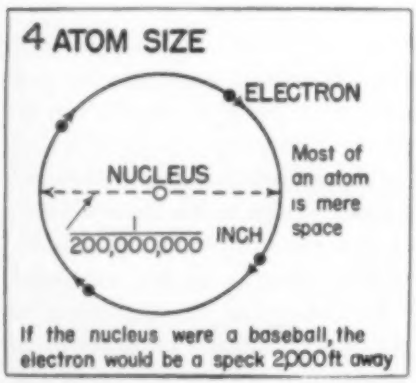


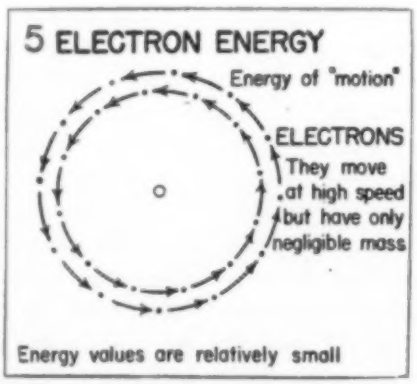


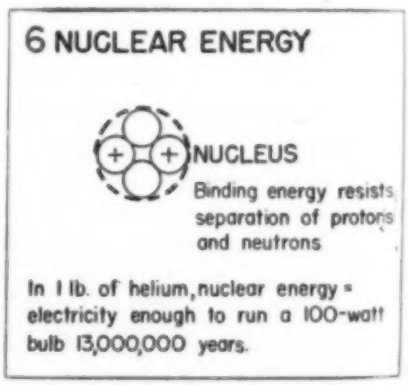


Each of the 92 elements has its own *atom*, yet all atoms are made from the same three pieces, Fig. 1: *proton* (weight 1, electric charge +1), *neutron* (weight 1, charge 0), *electron* (weight 0, charge −1).

Every atom is a tiny "solar system." Its central "sun" has one or more protons, generally neutrons too. The revolving "planets" are electrons, one for each proton in nucleus, because plus and minus must balance in the atom. The opposite charges attract, but high speed keeps the electrons out in their circular orbits, just as the centrifugal tendency of the revolving earth defies the sun's gravitational pull. All the weight of an atom is in the nucleus, so add the number of protons and neutrons to get the atom's weight. The *atomic number* is equal to the number of protons. The elements are known by their atomic numbers. Thus uranium (92 protons) is element 92.


4 ATOM SIZE
ELECTRON
NUCLEUS
Most of an atom is mere space
1/200,000,000 INCH
If the nucleus were a baseball, the electron would be a speck 2000 ft away


5 ELECTRON ENERGY
Energy of "motion"
ELECTRONS
They move at high speed but have only negligible mass
Energy values are relatively small


6 NUCLEAR ENERGY
NUCLEUS
Binding energy resists separation of protons and neutrons
In 1 lb. of helium, nuclear energy = electricity enough to run a 100-watt bulb 13,000,000 years.

With only their outermost orbits touching, it would take half a million atoms to span the thickness of a human hair. Yet if one could expand an atom until its outer orbits encircled 100 acres, the nucleus would be no bigger than a baseball. The atom is mostly empty space, Fig. 4, and nuclei are difficult targets; so much so that a neutron bullet fired at a mass of atoms may pass right through without a hit.

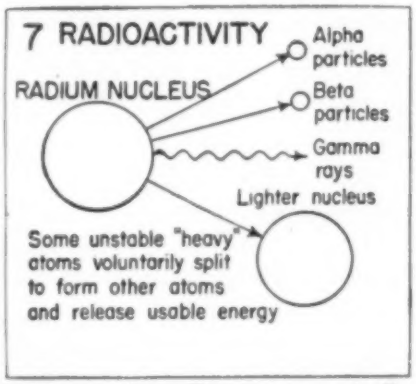
The almost weightless speeding electrons, Fig. 5, supply all the energy of chemical reactions (as when coal burns or TNT explodes). Evading all ordinary chemical action, the immensely greater energy bound up in the nucleus, Fig. 6, can be released only by direct hits on the nucleus to break the bonds that hold the protons and neutrons in a tight bundle.

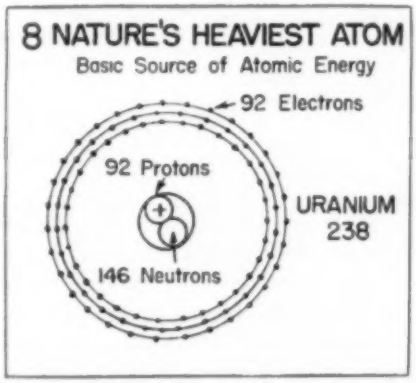
RELEASES ENERGY

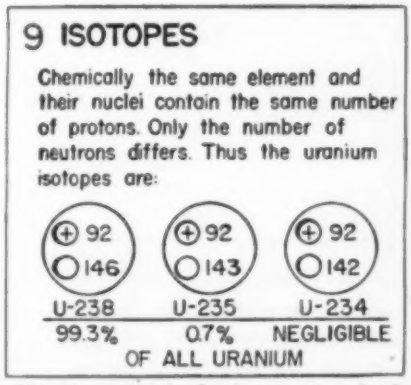
the fantastic course of atomic engineering through the five years of news blackout. It leaves no doubt that only a complete mobilization of America's technical resources could have won this victory in time.

Other writers in other places will unfold the epic story. This presentation leaves no space to reflect the glory of the accomplishment or even to record its history. The aim is more immediately practical — to give the professional and business readers of the McGraw-Hill publications a sound and honest, though non-technical, understanding of this atom-smashing business, so that they will know better what to do about it in their personal and business lives.

Now for step one: learning the shape of atoms and how atom splitting releases energy.

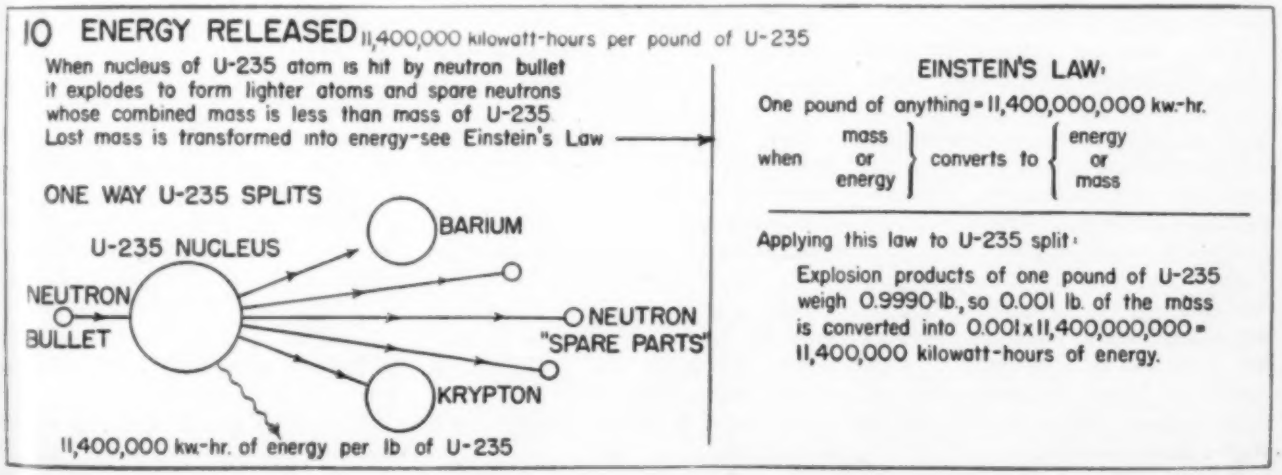






Radium nucleus, Fig. 7, automatically emits particles and energy as it decays to form nuclei of a lighter atom. Most common form of uranium, nature's heaviest atom, is Uranium 238, Fig. 8. This form is not directly useful for energy release, but is important as the raw material for a new synthetic power atom, *plutonium*.

An element may have several *isotopes* — alternate forms with the same number of protons but slightly different numbers of neutrons. Uranium 238 is the isotope in which protons and neutrons total 238 (so atom weight is 238). It is 99.3% of the total weight of pure, natural uranium. The stuff needed for direct atomic-energy release is Uranium 235, only 0.7% of the total weight and very difficult to separate from 238. To put it another way, every pound of energy-giving U-235 comes mixed with a dead load of 140 pounds of relatively inert U-238.


10 ENERGY RELEASED 11,400,000 kilowatt-hours per pound of U-235
When nucleus of U-235 atom is hit by neutron bullet it explodes to form lighter atoms and spare neutrons whose combined mass is less than mass of U-235. Lost mass is transformed into energy-see Einstein's Law
ONE WAY U-235 SPLITS
U-235 NUCLEUS
NEUTRON BULLET
BARIUM
NEUTRON "SPARE PARTS"
KRYPTON
11,400,000 kw-hr. of energy per lb of U-235
EINSTEIN'S LAW:
One pound of anything = 11,400,000,000 kw-hr.
when mass or energy converts to energy or mass
Applying this law to U-235 split:
Explosion products of one pound of U-235 weigh 0.9990 lb., so 0.001 lb. of the mass is converted into 0.001 x 11,400,000,000 = 11,400,000 kilowatt-hours of energy.

Slow neutron bullet splits Uranium 235 nuclear target, generating two lighter atoms (Fig. 10 shows one possibility) and several free neutrons ready to split other U-235 atoms. The following pages show how the original neutron may be produced and directed and how a chain of self-propagating atomic explosions may sweep through a block of U-235 like a forest fire to release heat energy equivalent to 11,400,000 kilowatt-hours per pound.

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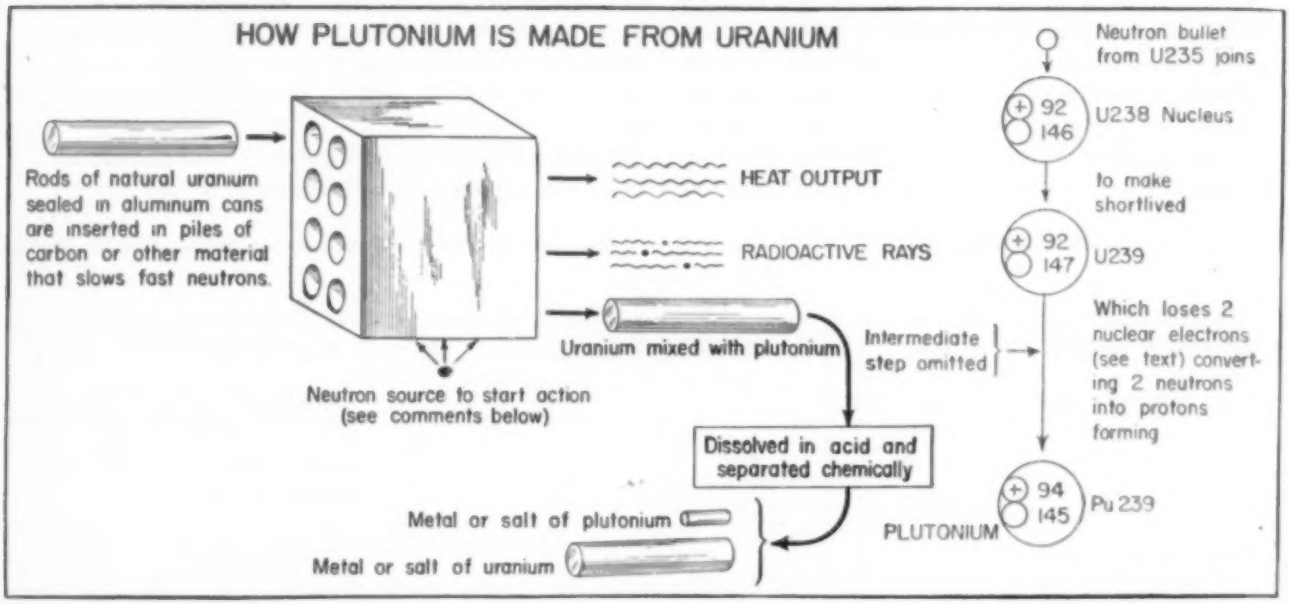
CREATING and ISOLATING

Man-Made Plutonium—U-235 Substitute


HOW PLUTONIUM IS MADE FROM URANIUM
Rods of natural uranium sealed in aluminum cans are inserted in piles of carbon or other material that slows fast neutrons.
HEAT OUTPUT
RADIOACTIVE RAYS
Uranium mixed with plutonium
Neutron source to start action (see comments below)
Dissolved in acid and separated chemically
Metal or salt of plutonium
Metal or salt of uranium
Neutron bullet from U235 joins
92 146 U238 Nucleus
to make shortlived
92 147 U239
Intermediate step omitted
Which loses 2 nuclear electrons (see text) converting 2 neutrons into protons forming
94 145 Pu 239
PLUTONIUM

We now have two kinds of atoms suitable for energy supply, Uranium 235 and the new man-made element No. 94, plutonium. Uranium, No. 92, has the heaviest atom of any natural element.

The Manhattan Project's plant, on the Columbia River at Hanford, Washington, is the world's greatest atom-making factory. Devoted entirely to the mass production of plutonium atoms, it uses U-238 as the raw material and U-235 as the energy source, intimately mixed in the same proportions as in natural uranium metal.

The production units at Hanford are several huge uranium "piles." Each is a very large block of graphite with holes in which are placed uranium-metal cylinders, sealed in aluminum cans to protect the uranium from corrosion by the cooling water constantly pumped through the pile.

Each pile runs itself, so to speak. Not even the conventionally pictured bits of radium, beryllium and paraffin are needed as a "pilot light" to start operation. There are always enough stray neutrons, or even cosmic rays, to start a chain reaction.

But once started, the design, size and control of the unit must be such that the chain reaction will continue at an even rate—neither die down nor overshoot into an explosion.

To see this picture in atomic terms, consider the fraction of a second in which one million U-235 nuclei are split, producing two million lighter atoms (say, one million of barium and one million of krypton) and between one and three million fast-moving neutron projectiles.

Some of these escape in free flight right through the relatively vast atomic "open spaces." Some are "captured" by the many U-238 nuclei, and others are captured by the impurities. But, on the average, of the one to three million, just one million neutrons must succeed in smashing another million U-235 atoms in the next fraction of a second. Thus, with reproduction rate exactly maintained, life goes on in the atomic-energy pile.

The carbon, one of several possible "moderators," serves to slow down the neutrons without capturing many. The chance of a fast, straight-moving neutron hitting a tiny nucleus is very small, whereas the "slow ball" neutron is likely to be sucked in by the nuclear attraction if it would otherwise be a near miss.

From the practical angle, maintaining a chain reaction requires careful design and good controls. The pile must be slightly larger than actually necessary for a chain reaction (that means scores of tons of material). Controls must be sensitive and dependable. They slow the pile down to the balancing point by sliding in retarders, such as strips of cadmium.

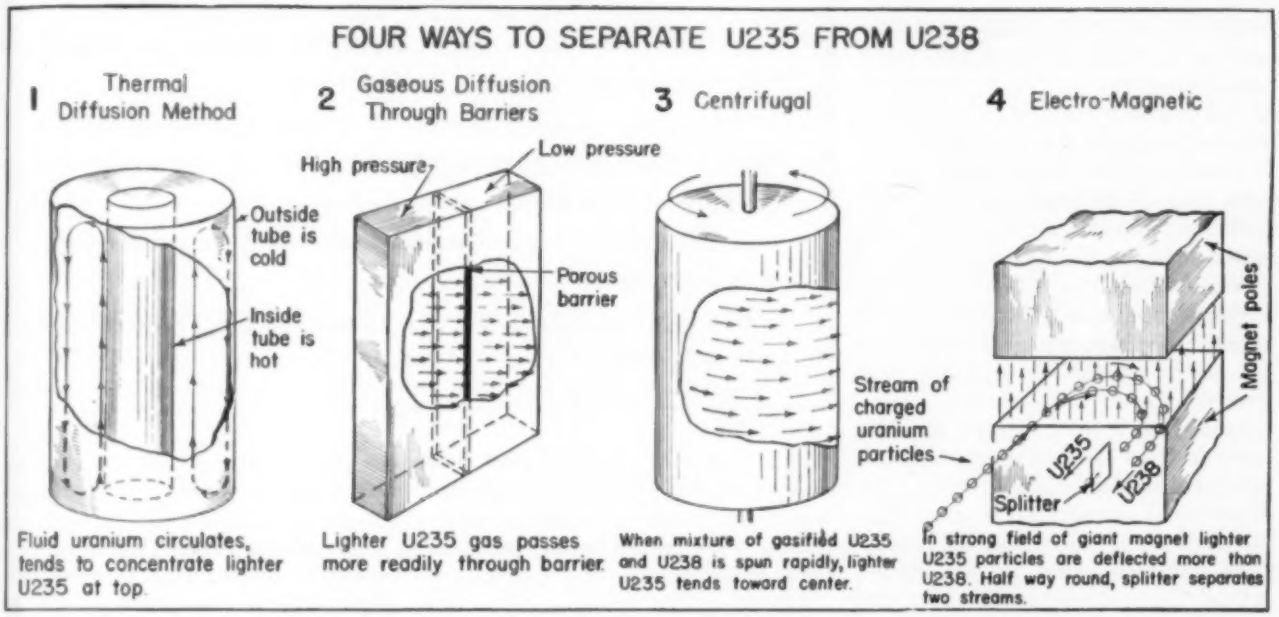
As already noted elsewhere, the energy released is about 11,400,000 kilowatt-hours for each pound of U-235 split. This energy appears first in the high speed of the pieces thrown off by the atomic split, then is converted to sensible heat as collisions slow down these projectiles. The energy is finally removed from the pile in the form of hot air, steam, hot water or other heated fluid in commercial quantity and thermal condition.

Such piles, operated with normal uranium, or with uranium enriched in U-235, would seem to be the primary means by which atomic energy will serve (if ever) as a commercial source of heat and power. Plutonium would be a byproduct, but might under certain conditions add to the energy yield of the pile without the need to separate it from the uranium.

The use of normal uranium in the Hanford pile sounds extremely attractive as a heat source, but has certain economic disabilities. Only a small part of the U-235 is used up before the pile must be shut down to remove the plutonium.

THE HIGH-POWER ATOMS

Isolating U-235 — a Gigantic Task


FOUR WAYS TO SEPARATE U235 FROM U238
1 Thermal Diffusion Method
2 Gaseous Diffusion Through Barriers
3 Centrifugal
4 Electro-Magnetic
Outside tube is cold
Inside tube is hot
High pressure
Low pressure
Porous barrier
Stream of charged uranium particles
Magnet poles
U235
U238
Splitter
Fluid uranium circulates, tends to concentrate lighter U235 at top.
Lighter U235 gas passes more readily through barrier.
When mixture of gasified U235 and U238 is spun rapidly, lighter U235 tends toward center.
In strong field of giant magnet lighter U235 particles are deflected more than U238. Half way round, splitter separates two streams.

Many of the uranium ores, including most samples of pitchblende and carnotite, will yield from 1 to 15% metallic uranium. Chemical separation of the metallic "natural" uranium is simple. Whatever the source, natural uranium contains the three isotopes in the constant proportions of 99.3% U-238 and 0.7% U-235, with traces of U-234.

Separating the U-235 from U-238, an operation essential for explosive uses of U-235, and probably important for future commercial controlled-chain piles, has been most difficult. Chemical separation was impossible because U-235 and U-238 are chemically the same.

The only possibility was a separation by physical differences, primarily a one percent difference in weight. The porous barrier and centrifugal methods pictured above required vaporizing a salt of uranium. All the methods shown have been used or tried on the Manhattan Project. All require many stages to achieve a substantial concentration of Uranium 235.

Dollarwise Thoughts on Atomic Energy

Costs mean little in war, but peacetime uses of U-235 and plutonium must pass the dollar test in competition with coal, fuel oil, natural gas, gasoline and electricity.

On the basis of energy costs only, *"all other things being equal,"* the table on the last page of this section shows at what price per pound U-235 would give the same energy cost as conventional energy sources selling at the indicated prices. For such comparisons it is convenient to remember that one pound of U-235 is equal (energy-wise) to about 11,400,000 kilowatt-hours, also to 1500 tons of coal, or 200,000 gallons of gasoline.

Fuel engineers understand the limitations of such oversimplified comparisons. Others should be warned that "all other things" are never equal. With this thought in mind, reconsider the uranium piles operated at Hanford to produce plutonium. These use U-235 in the cheapest form, say about $1400 per lb., assuming purified normal uranium at $10 per lb. (140 lb. of uranium contains one pound of U-235.)

If this were the whole story, coal would have to sell for a dollar a ton to break even with U-235 as a water heater. However, the pile using normal uranium must be immense to hold its own in a chain reaction. More important, the accumulating fission products "poison" the reaction after only a small part of the U-235 has been used up. Then the uranium cylinders must be removed for plutonium recovery. Finally, it has not yet been found possible to operate the normal-uranium piles at high enough temperatures for practical power production.

If we go to the other extreme and build a small pile, using concentrated U-235, we shall run into excessive material costs, perhaps several times the $52,000 per lb. set down in the table as the equivalent of 20-cent gasoline.

Something between the two extremes is likely to prove the most economical — perhaps a pile operating on a U-235 concentration between 1 and 10%.

The engineer of the "atomic-power age" must know the price of Uranium 235 *in various concentrations* and the characteristics of piles suited to them. No such information is yet available. He must also watch the danger from radio-activity; the requirements for radiation shields; explosion hazards, etc.

CONTINUED ON NEXT PAGE

WHAT TO EXPECT F

CLAIMS LIKE THESE ARE NOT JUSTIFIED

1. Pretty soon no more coal will be mined except as a raw material for chemical manufacture.

2. In a few years a tiny bit of uranium, built in at the factory, will drive your car for life through an engine no bigger than your fist.

3. All the big central stations will soon be running on atomic power.

4. Cheap atomic energy will enormously reduce the price of power.

Before discussion of possible and probable future applications of atomic energy to the arts of peace, the atomic bombs should have consideration. We may assume that these bombs contained from two to 200 lb. of either U-235 or plutonium, or both. No more precise information is available.

Details of the bomb design have been completely suppressed, but the following basic considerations are stated or implied in the Smyth Report:

The explosive in a bomb must be highly concentrated U-235 or plutonium. Since slow neutrons could not produce a satisfactory explosion, the neutron retarder or *moderator*, is minimized. This, in turn, requires a U-235 mass so large that the escape of neutrons without hitting nuclei will not be excessive. For every 1000 atoms hit, the neutrons produced must split more than 1000 new atoms, so that the reaction will proceed rapidly in an expanding chain, as sketched below.

There can be little leeway in the size of the explosive charge. For a given shape there is a certain "critical" weight of material. If this is exceeded the bomb explodes instantly. If the weight of charge is less than the critical, it cannot be made to explode.

Therefore, the critical mass must be created at the moment of explosion.

The Smyth Report suggests that this can be accomplished by breaking down the charge into two or more well-separated parts, each having less than the critical mass. At the appointed moment these could be brought together within the bomb to create a supercritical mass, which would then explode automatically.

Peacetime Applications

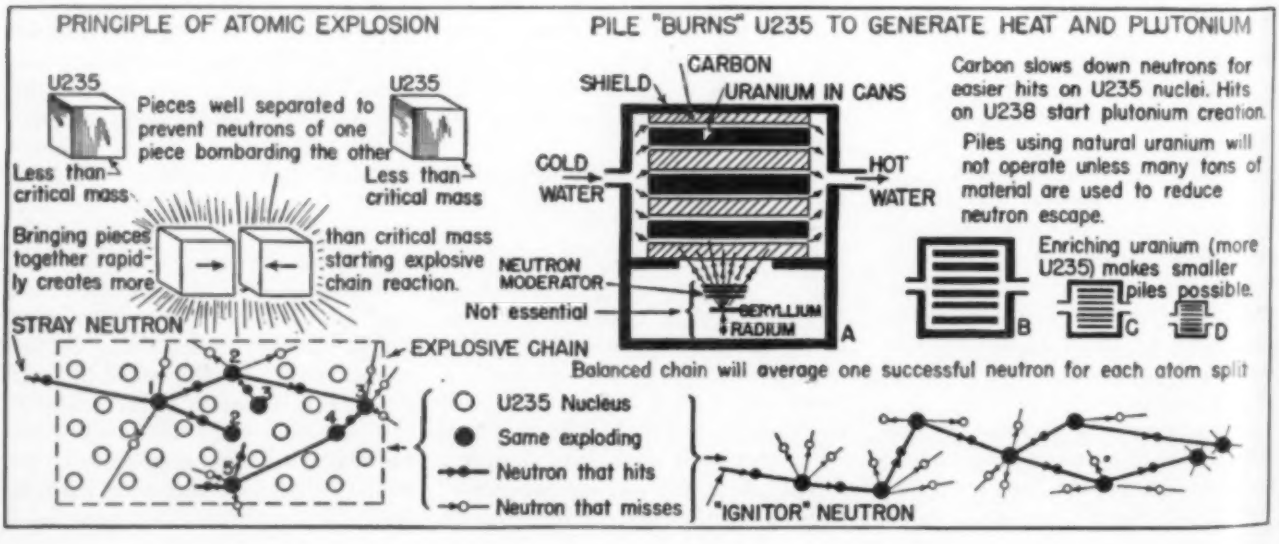
Except possibly for superblasting operations, uncontrolled explosive reactions cannot be permitted in the peacetime use of atomic energy. This means that the quantity of U-235 assembled in any one spot must always be kept well below the critical weight to avoid spontaneous explosion.

Depending on the particular application, the most desirable concentration of U-235 may range anywhere from the 0.7% in normal uranium up to 100%, with the probability that many industrial applications will find the greatest economy in concentrations between 1% and 15%.

This matter of the degree of concentration of U-235 has received little public attention, yet nothing could be of greater practical importance. To make this point clear, consider the two extremes, 0.7% of U-235 and 100% of U-235, respectively.

The Hanford pile, using normal uranium (0.7% U-235) with carbon moderator, must be very large to work at all. It is inefficient in the sense that it must be shut down after a small part of the U-235 has been consumed. It cannot operate at high temperatures.

Its great advantage as a heat producer is the fact that its U-235 is bought at the lowest possible price. If


PRINCIPLE OF ATOMIC EXPLOSION
U235
Less than critical mass
Pieces well separated to prevent neutrons of one piece bombarding the other
U235
Less than critical mass
Bringing pieces together rapidly creates more than critical mass starting explosive chain reaction.
STRAY NEUTRON
EXPLOSIVE CHAIN
PILE "BURNS" U235 TO GENERATE HEAT AND PLUTONIUM
SHIELD
CARBON
URANIUM IN CANS
COLD WATER
HOT WATER
NEUTRON MODERATOR
Not essential
BERYLLIUM
RADIUM
A
Carbon slows down neutrons for easier hits on U235 nuclei. Hits on U238 start plutonium creation.
Piles using natural uranium will not operate unless many tons of material are used to reduce neutron escape.
Enriching uranium (more U235) makes smaller piles possible.
B
C
D
Balanced chain will average one successful neutron for each atom split
U235 Nucleus
Same exploding
Neutron that hits
Neutron that misses
"IGNITOR" NEUTRON

FROM ATOMIC ENERGY

. . . BUT REMEMBER THESE FACTS

1. The large-scale, controlled release of heat energy from U-235 has been fully demonstrated.

2. Beyond question, this energy could be applied directly for heating water and air, and making steam.

3. Such heat, in turn, could be applied directly, or converted into mechanical power or electricity by conventional steam turbines and gas turbines.

4. If and when U-235 in concentrations up to 10% costs less than $25,000 per lb., it may find applications, but will compete, at first, with premium fuels rather than coal.

purified normal uranium sells for, say, $10.00 per lb., the price of 140 lb. (containing one lb. of U-235) will be only $1400. This would be a very favorable price if the pile could operate efficiently with the 0.7% U-235.

Concentrating the U-235 to 100% would permit a much more compact and convenient pile — perhaps little more than small pieces of U-235, encased in aluminum to ward off corrosion, and immersed in a tank of water; this should convert the water into steam at a regulated rate.

In large part, the control would be inherent. The water as a moderator would keep the chain going, but if the reaction got too violent, the resulting higher superheating of the steam would decrease the moderator effect and thereby hold the reaction in check. Yet even if all this comes true the cost of concentrated U-235 in the near future will be many times $10,000 per lb.

Running up the concentration only a few percent above that in normal uranium may prove to be the way to get reasonable pile size and good efficiency without incurring exorbitant concentration costs.

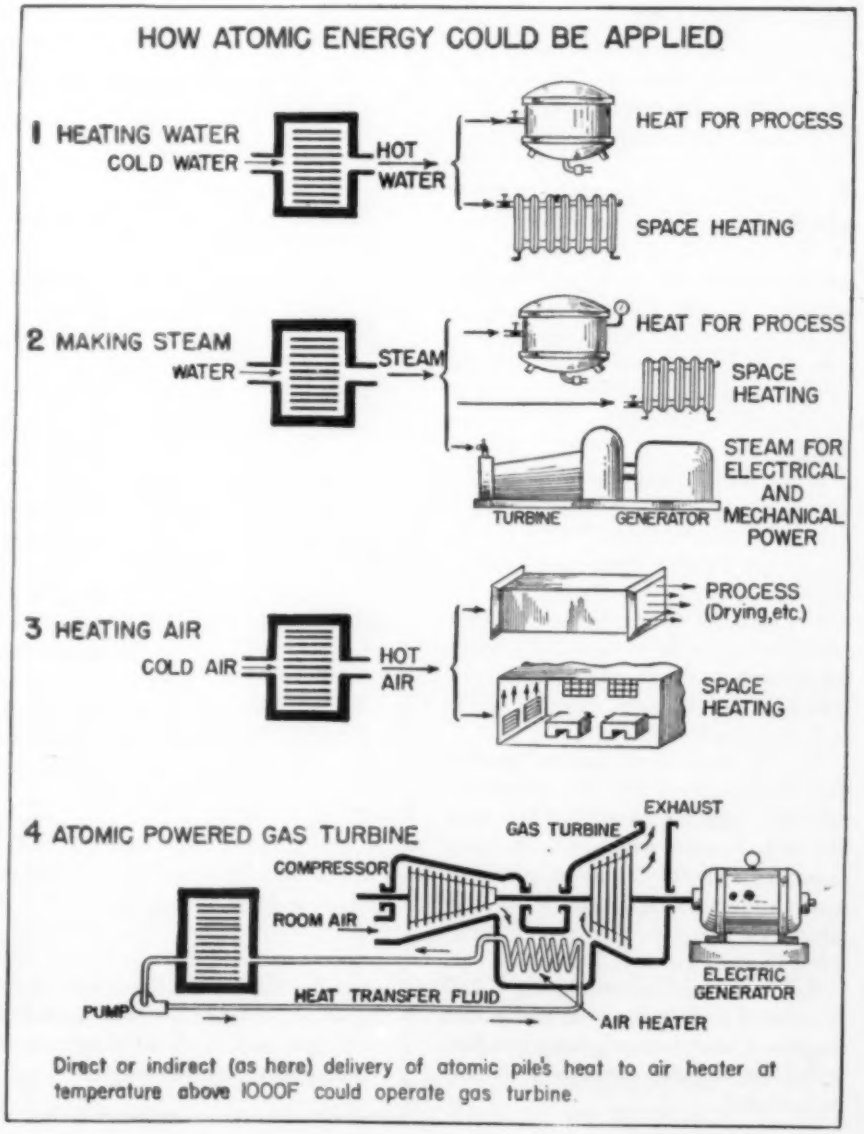
When atomic energy is applied, the starting point is heat, picked up by water, air or a special heat-transfer fluid. Intermediate heat transfer fluids may be essential in certain applications (space heating and service water, for example) where people must be protected from injury by radioactivity.

The intermediate heat-transfer fluid shown for the gas turbine would, of course, have to operate at temperatures up to 1200 F. There seems to be no basic reason why the pile itself could not be built inside the compressed-air receiver, discharging its heat directly to the compressed air.

With rather high concentration of U-235, this arrangement might be suitable for large airplane drive if excessive weight of radiation shields could be avoided.

Also, presumably, rockets and planes of the "buzzbomb" type could be powered by atomic heat delivered to the air of the jet steadily, not in puffs.

The sketches stress direct applica-



Direct or indirect (as here) delivery of atomic pile's heat to air heater at temperature above 1000F could operate gas turbine.

THESE THINGS MIGHT RESTRICT USE OF ATOMIC ENERGY

1. Ineffectiveness of large piles using normal U-235 concentration

2. High cost of concentrated U-235 for smaller, more effective piles

3. Danger from radioactivity

4. Weight and cost of shielding against radiation

5. Explosion hazard

6. Possible short supply of uranium

7. Governmental restrictions on atomic-energy materials

tions of hot air, steam and hot water to process and space heating. This emphasis is justified by the often overlooked fact that such applications of heat have many times the total energy value of all the electricity generated in the United States for all purposes.

There has been much popular speculation regarding the type of engines required for atomic-power generation. The answer is simple. Present engines, steam turbines and gas turbines can be used with little or no change. This, of course, does not rule out the possible discovery of specialized engines for atomic power, or even direct production of electricity from atomic energy.

In the long run the implications of atomic power are staggering for both war and peace. However, popular writers on the subject have undoubtedly created unreasonable hopes in the minds of readers — for example, the expectation that in two or three years the Detroit builders will market cars with built-in "lifetime" slugs of U-235 and "fist-sized" engines.

Yet it seems fairly safe to predict that atomic energy will find some commercial applications within the next five or ten years, first, probably, as a premium fuel like aviation gasoline, worth a fancy price for specialized applications where low weight or some other characteristic is important.

As the cost of concentrating U-235 is reduced and application efficiencies improved, atomic energy may compete with cheaper fuels, perhaps ultimately with coal.

Important non-power applications of atomic energy may well include the ultra-high-temperature processing and fabricating of materials — also, modern "alchemy": building and rebuilding atoms to create new elements and to produce old elements at lower costs.

Radioactivity obtained directly or indirectly from artificial atom-splitting should find many important medical and industrial applications.

Turning back to ordinary power applications, we must avoid the temptation to overstress the economic importance of lower-cost power fuel. Fuel cost is only about 17% of the gross receipts of the electric utilities. Here's another way to put it: If, after allowing for transmission losses, one kilowatt-hour delivered to the consumer from modern plants represents a coal consumption of 1.5 lb., and if the coal costs $5.00 per ton cancellation of the coal bill could not save more than ⅜ of a cent per killowatt-hour. And atomic fuel will certainly not be free.

Performance of the atomic bomb is a monument to the scientists who unlocked the secrets of the atom and suggested the basic technique of making plutonium and concentrating U-235.

From there on, the job was at least 50% engineering. The various big plants of the Manhattan Project are vast assemblages of pipes, tanks, boilers, valves, instruments and controls, installed and operated by engineers, largely designed by engineers. From now on, the speed with which atomic power becomes practical will depend on the effectiveness of the engineer-scientist team.

It is possible, of course, that national controls may completely upset the entire technical and economic pattern of this discussion. For reasons of national security the government may decide to control or restrict atomic-power materials, plants and operations in ways not yet determined.

U-235 COULD COMPETE AT THESE PRICES

other things being equal

Common fuel	*Assumed prices*	*Comparable prices for Uranium 235, dollars per pound (nearest thousand)*
COAL (13,000 B.t.u.)	$6 per ton	$9,000
	$12 per ton	$18,000
	$15 per ton	$23,000
FUEL OIL (150,000 B.t.u. gal.)	2¢ per gal.	$5,000
	4¢ per gal.	$10,000
	8¢ per gal.	$20,000
CITY GAS (500 B.t.u.)	50¢ per 1000 cu. ft.	$39,000
	$1 per 1000 cu. ft.	$78,000
NATURAL GAS (1000 B.t.u.)	25¢ per 1000 cu. ft.	$10,000
	50¢ per 1000 cu. ft.	$20,000
	$1 per 1000 cu. ft.	$40,000
GASOLINE (150,000 B.t.u. gal.)	10¢ per gal.	$26,000
	20¢ per gal.	$52,000
	30¢ per gal.	$78,000

BUT

Note that "other things" are never equal. U-235 in normal uranium form is by far the cheapest, but involves use of excessively large and inefficient "piles." The unit cost of the U-235 in enriched mixtures increases with the degree of enrichment. Over-all cost comparisons can be made only for a specified concentration of U-235 and for apparatus suitable for that particular concentration. Possible explosion danger and need to protect personnel against radiation are other important considerations.

CHEMICAL
& Metallurgical
ENGINEERING

ESTABLISHED 1902 S. D. KIRKPATRICK, Editor

SEPTEMBER 1945

Momentous Months, These

"A THOUSAND years have passed since the dropping of the first atomic bomb." Such was the viewpoint of the editor of *The Saturday Review of Literature* in a thought-provoking paper presented at the recent Columbia University Conference on Science, Philosophy and Religion. Mr. Cousins touched off some verbal fireworks among those who would blame most of the world's ills on the "social impact of science." Yet both the natural and the social scientists present seemed to agree that in recent months mankind has been leaping ahead by decades, if not by centuries, and perhaps without being ready or willing to face the consequences.

War's sudden end in Japan upset industrial as well as military schedules. Reconversion had been talked about in Washington for at least a year, but when the time came for action there was no comprehensive plan or program. War controls and restrictions were lifted almost overnight and industry was told to get out and shift for itself. This was strong medicine and good for our souls—even if we were left a bit dazed by the suddenness of the new freedom. Is industry to return to where it left off five years ago, or is there a way to translate the speed and momentum of war into production for peace?

For chemical industries the road ahead is not the old "road back to normal." We have learned too much to be satisfied with past achievements. We have seen how great research and development programs, pressured by war's necessity, can give us new and revolutionary weapons and materials. The success of the atomic bomb project is proof that neither size nor complications need limit our future undertakings. A billion dollars for a synthetic rubber industry, as much again for aviation fuels, light metals and rockets—these have taught us to think and plan on a bigger, broader basis. To say that we are not now able or willing to tackle the social, economic and political problems of the peace is an admission of defeat—a willingness to surrender the most important of our wartime gains.

The material objectives we want most to attain in this country are concerned with an expanding economy, with continuing improvement in living standards, working conditions and employment. We cannot have these without bold plans and hard work in producing more goods at lower costs. If as individuals, companies or industries, we set out on such a program as that outlined by the Committee for Economic Development, for example, we should be as sure of reaching these objectives as were our task forces in Europe and Asia, or as the Manhattan project. We need most the will to want to go ahead on our own rather than be dependent upon direction and support from Congress or other agencies of government.

We are inclined to agree with Mr. Cousins' conclusion that scientific developments in the past few months have greatly accelerated "the obsolescence of modern man." But just as we must find a new road ahead in our technical and industrial progress, so is there now greater need than ever for new thinking and planning for our social and political progress. As we come face to face with forces like the atomic bomb, which in irresponsible hands could literally wipe out our present-day civilization, we must "develop a sense of responsibility for the vast power we now possess." That job cannot be left solely to the statesmen and politicians. All of us—scientists and laymen alike—must accept a share of this responsibility for promoting peace and understandings, for putting moral and spiritual values above our scientific and material gains.

EDITORIAL STAFF SUMMARY

Conquest of Uranium and the ATOMIC BOMB

Since release of information on the facts underlying the atomic bomb, editors of *Chem. & Met.* have been accorded the privilege of entering two of the three areas involved in this tremendous development. J. R. Callaham visited the Hanford plutonium plant, the results of this visit being described in a separate article. T. R. Olive made a general inspection of the Clinton area. For security reasons, of course, neither editor was permitted to obtain information not in the Smyth report.* However, both obtained something that neither the Smyth report nor the millions of words that have appeared in the press can give: an actual conception of the almost unimaginable magnitude of the development and of the overpowering size and impressiveness of the plants. Compressed into approximately four years as most of the work was, it is hard to believe that it could have been completed in 20 years.—*Editors*

At about noon, Eastern war time, on August 6, 1945, the world learned that the long quest for a means of splitting the atom had been a complete and unqualified success, yielding a weapon so irresistible that within a few days Japan was to accept unconditional surrender. Hardly had the first bomb fallen, however, before those who felt its use immoral were rending the air, on the one hand; while those who expected uranium shortly to supplant all other power sources were at the same time equally clamorous. It is not our purpose here to refute either group, although that is not difficult. A special insert appearing ahead of p. 101 in this issue was prepared for all McGraw-Hill magazines to take care of the "atom-energy-now" gentry, at the same time giving in simple fashion the underlying nuclear physics, and appraising reasonably the possibilities for the future. Here and now our purpose is to summarize briefly for engineers a little of the underlying theory and as much as can be told of the actual development, within the bounds of security as delineated by the Smyth report.*

Unfortunately for engineering curiosity, but perhaps in the best interests of security, little of the engineering part of the story can now be told. The Smyth report itself is concerned chiefly with the underlying physical and chemical principles, and with the organization and personnel picture from 1940 to 1945. Some day the engineering story will be told, an even more impressive account, if that is possible, than the record of scientific accomplishments, for physical theory in 1940 was already in a fair state, but most of the engineering required was new!

As of June 30, 1945, Congress had appropriated $1,950,000,000 for all phases of the uranium project, an enormous figure before these days of billions, but now completely incapable of conveying any idea of the effort involved, the urgency, the armies of workers in all categories, and the sheer, overpowering size of the physical facilities that resulted. With more than 125,000 people engaged in all phases of the job at one time, there are still in the neighborhood of 75,000 at Clinton and 17,000 at Hanford (including workers' families) which, in itself, involved a tremendous job of feeding, housing and providing the other needs of life. Richland, Washington, built to house the workers at the Hanford Engineer Works, is a fair sized town. Oak Ridge, Tenn., likewise built from scratch for the benefit of those who constructed and those who now manage and operate the Clinton Engineer Works, is actually the fifth city of Tennessee!

So much for the problems of workers, rather than products, for the former have been treated adequately in many places. Our primary concern here is with the largest single group of chemical engineering projects of all time. Other engineers may be disposed to point out that these were also civil and electrical engineering projects, and the end product of the research of physicists. True as this is, chemical engineering pervades them all and chemical engineers form the most numerous category of technologists among the design and operating groups alike. This is only a natural consequence, of course, of the well known fact that chemical manufacturing processes are the result of the application of engineering to physical and chemical phenomena.

ENERGY FROM ATOMS

Long before 1939—in fact, as far back as 1905 when Einstein proved mathematically the equivalence of mass and energy—the idea had been prevalent that energy would some day be obtained by splitting the atom, for it was known that in so doing, some of the mass would be lost as such, to reappear in the form of kinetic energy. When in 1939 it was found that uranium, the least stable element, and the one of highest atomic weight, could actually be split, with the release of the same kind of sub-atomic particles that caused the initial split, a race was immediately on, world-wide in scope, to determine whether a chain reaction of self-sustaining character might not be possible. Should this be attained, each atom would release energy equal approximately to the energy obtained in burning 1,000,000 atoms of coal, and explosions of unparalleled force would be feasible if a fast reaction resulted.

* Released to the press by the Army on August 12, the 178-page report by H. D. Smyth, Manhattan District consultant, chairman of the department of physics at Princeton, was entitled "A General Account of the Development of Methods of Using Atomic Energy for Military Purposes Under the Auspices of the United States Government, 1940-1945." Copies for public sale were available in a reprint by Princeton University Press by mid-September.

Actually, in 1939, it was not realized that of the three natural isotopes in natural uranium metal, only U-235 was capable of splitting, or fission, when bombarded with neutrons to crack the nucleus. If this had been known perhaps the search would not have been so readily undertaken, for U-235 is present to the extent of only 0.7 percent of the purified natural metal. It would probably have been realized that the preponderant isotope, U-238, constituting nearly all the remainder, would prevent U-235 fission by the then known means through absorption of the neutrons, preventing more than a negligible few from ever reaching the nuclei of U-235 atoms.

MAN-MADE ELEMENT

Within a year the situation was beginning to be understood for the isotopes had been separated and U-235 fissioned. Fortunately, however, the theory had progressed and it now seemed likely both that U-235 could be concentrated by practical methods, and that a chain reaction producing a hitherto non-existent, fissionable element, plutonium, could be brought about. Plutonium had been synthesized during that year by shooting neutrons into the U-238 nucleus with the University of California cyclotron. Perhaps these neutrons could be supplied in simpler fashion. If the U-235 in natural uranium could be made to split, shooting one of the neutrons released by each fission into another U-235 atom, and another neutron into an atom of U-238, plutonium would be produced along with enormous amounts of heat energy. Tremendous effort was then directed toward determining if this could be accomplished, but positive results were not obtained definitely until the end of 1942. The delay resulted not so much from lack of understanding as from scarcity of materials. For nuclear chain reactions, in addition to their requirement for high purity materials to reduce unwanted neutron absorption, introduce a new concept, that of critical size.

From left to right: Maj. Gen. Leslie R. Groves, officer in charge of the Manhattan District; Brig. Gen. Thomas F. Farrell, assistant to the officer in charge; and Col. K. D. Nichols, district engineer of the Manhattan District

Because the neutron loss from an operating mass or "pile" is a surface effect, while the useful results of neutron bombardment within the pile are proportional to volume, the ratio of exterior surface to volume must be less than a certain maximum, depending on the geometry of the pile. This means that the system volume must be more than a certain minimum if the neutron loss is to be held down enough for a chain reaction to continue. This concept is an important one to note, for it controls the minimum size, both in the chain reacting bomb and in the plutonium producing reaction. It may be expected, as well, to control the size of the reacting mass in future efforts at atomic power production.

By 1941, then, the aims were definitely established. First, practicable means were to be discovered for separating the U-235 at a desired degree of purity from natural uranium metal, and second, other means were to be worked out for producing plutonium from U-238 by the expenditure of the U-235 naturally associated with it. However, there was no assurance that the amount of plutonium produced would be equivalent to the U-235 expended so, on its face, the proposal seems of questionable merit in light of the since-confirmed belief that U-235 and plutonium would be about equivalent as bomb material. The main reason for the plutonium program was that, whereas isotopes are identical chemically and hence can be separated only by *physical* methods responding to small differences in mass, plutonium is a different element and hence can be separated *chemically* from the unconverted U-238 and other materials in the reaction mass. Furthermore, it is likely that the tremendous heat output of the plutonium process will make it of major interest for power production in the future.

Large production area at Oak Ridge, Tenn.

ISOTOPE SEPARATION

Isotope separation processes turned out to constitute a decidedly important, as well as the most costly part of the over-all program. Expenditures on that phase, up to the dropping of the first bomb, amounted to $1,106,393,000, compared to $383,401,000 for the plutonium project and $54,429,000 for the bomb laboratory near Santa Fe. Two separation processes were finally adopted for U-235 production, and two complete plants were

Chronological Highlights in Atomic Bomb Development

In 1896 Lord Rayleigh was the first to use porous diffusion in the separation of gas molecules, while Becquerel initiated the modern study of atomic structure by discovery of radioactivity. Two years later the Curies discovered radium and in 1905, as a consequence of his theory of relativity, Einstein announced the equivalence of mass and energy. In 1919 Rutherford was the first to disturb the stability of an ordinary atomic nucleus.

Until the chain of discoveries of the 30's, Einstein's hypothesis was unconfirmed. In 1930 Bothe and Beck, in Germany, discovered but did not identify the neutron. Chadwick, in England, identified this electrically neutral particle in 1932. During the same year H. C. Urey discovered heavy hydrogen and heavy water and C. D. Anderson, also in the United States, discovered the positron. Also in 1932, in Rutherford's laboratory in England, experiments leading to the confirmation of Einstein's calculations were performed.

Then in 1939, things began to happen, atomically speaking. Early in January Hahn and Strassmann, in Germany, announced that they, together with Lise Meitner, had found a barium isotope (about half the atomic weight of uranium) in the products of bombardment of uranium by neutrons. Dr. Meitner, by then exiled from Germany, almost immediately deduced correctly, and so informed Frisch at Copenhagen, that atom splitting (fission) had occurred. This was communicated to Niels Bohr, of Copenhagen, then visiting in the United States, and confirmed by Frisch by mid-January. Within a few days, before Frisch's results were known in the United States, four U.S. colleges re-confirmed this conclusion. Apparently the German government almost immediately set about large scale atomic bomb research.

U.S. scientists were not left behind. In March 1939 G. B. Pegram and Enrico Fermi contacted the U.S. Navy to suggest a uranium program, finding mild interest. In the Fall, Alexander Sachs talked with the President who foresaw the possibilities and appointed an advisory committee on uranium. By December interest in atomic fisson was so great that 100 papers had appeared.

By February 1940 A. O. Nier, at Minnesota, had separated the uranium isotopes with his mass spectrograph and his U-235 sample had been split by J. R. Dunning and his associates at Columbia. In the same month the first Navy appropriation became available. By April news of the German large-scale effort accelerated our own work and that of the British and resulted in our adopting a voluntary censorship policy on scientific papers. In June formation of NDRC under Vannevar Bush, and its uranium subcommittee, gave further impetus. Work on isotope separation was actively under way at Columbia under Urey and Dunning, and the possibility of using thermal diffusion in liquid as a separation means was suggested in the Fall. During the year it became more evident that a power chain reaction of uranium was possible. At this stage most of the work had been concentrated at Columbia, although E. O. Lawrence at the University of California had efforts under way to synthesize element 94, plutonium, with the cyclotron, and the idea of a chain reaction for its formation from U-238 was developing.

It was in 1941 that the uranium project really began to gather momentum. Interest in the possibilities of a chain reaction, either for explosion or for plutonium formation, became great enough to lead to projects at Princeton and California, as well as at Columbia. H. D. Smyth, at Princeton, and Lawrence, at California, became interested in electromagnetic methods of isotope separation and by the year end, the latter had made U-235 samples. At Columbia, Fermi was working on the chain reaction pile, and Urey on diffusion separation and heavy water. Experiments on centrifugal separation were under way at several places, diffusion separation had been demonstrated on uranium hexafluoride, the theory of such separation was well understood and thermal diffusion had been demonstrated. The groundwork for a chain reacting pile had been partially completed, but a pile had not been achieved.

built at the Clinton Engineer Works, as well as numerous subsidiary plants that served the main ones.

One reason for the extremely wide scope of the research program that preceded actual building of the Clinton separation plants was the fact that several alternate methods for accomplishing certain results were often worked on concurrently, both as insurance and to permit evaluation of their relative merits. Lack of space here, unfortunately, will prevent the description of interesting and possibly valuable methods which were abandoned for one reason or another before the plant stage was reached, often because a procurement problem or some other deterrent (which might be lacking in the future) had intervened.

It was recognized at an early stage that two classes of separation methods were possible for the concentration of U-235, a group given the name of "statistical" methods, all depending on small differences in the average behavior of the molecules of different isotopes; and a group of electromagnetic methods, based on the fact that different velocities could be imparted to ions of different mass in an electromagnetic field. Distillation and centrifugation, although possible separation means for atoms of different mass, have not survived the experimental stage, while gaesous diffusion is now used on an enormous scale for the production of a high U-235 concentrate, and thermal diffusion is used (probably less extensively) in making a low concentrate raw material for the surviving electromagnetic process. An exchange reaction combined with electrolysis, both statistical methods, is used in heavy water production. This, however, applies only to an experimental phase of the project and hence cannot be covered here in detail. Although reports from Germany suggest that the Germans may have been placing chief reliance on heavy water in the production of plutonium, such has not been the case in the United States, owing primarily to the difficulty of securing the enormous quantities of this material that would have been needed.

Gaseous Diffusion—Perhaps the most interesting phase of the entire project from a chemical engineering standpoint is the gaseous diffusion process, practiced on an almost unimaginably large scale at Clinton. Work on this process was initiated at Columbia where, in fact, much of the work on other problems also was started, giving rise in 1943 to the Army's name of "Manhattan District" for the work on uranium. It was shown at an early date that fluorine, occurring in but one atomic form, reacted with the isotopes of uranium to form but three possible gaseous hexafluorides, and that a small degree of concentration of the lighter U-235 F_6 could be achieved after diffusion through a porous barrier, accomplished by a small depletion of the heavier U-238 F_6 after flow through the same barrier. This followed, of course, from the fact that all the molecules have the same temperature and aver-

One of the plants in the Clinton Engineer Works

Accomplishment had progressed so far at this time that it was deemed feasible to set up a planning board of engineers to supervise technical and engineering aspects, procurement, plant design and construction. The board, headed by E. V. Murphree, included also W. K. Lewis, L. W. Chubb, G. O. Curme, Jr., and P. C. Keith.

In 1942 the earlier efforts began to bear fruit. By the end of 1941 there were 16 research contracts in force, totalling $300,000, but only a few grams of uranium metal were in existence. In 1942 the problems of metal and other raw material procurement were largely solved; success of the calutron electromagnetic method of U-235 separation was demonstrated beyond a doubt; progress had been made on barriers for diffusion separation; and enough of the chemistry of plutonium was known to give an idea of means for its separation. Early in the year the problem of plutonium production had been transferred to University of Chicago under A. H. Compton, and at the year end the first chain reaction of self-sustaining character was demonstrated before a review committee of engineers including W. K. Lewis, C. H. Greenewalt, T. C. Gary, Roger Williams and E. V. Murphree.

During the latter part of the year first steps toward acquiring the Clinton site were initiated; the calutron design was frozen and the building of a large scale electromagnetic separation plant was recommended; Du Pont was called in on plutonium plant design and the Hanford site was examined; and M. W. Kellogg's subsidiary, Kellex, was starting preliminary diffusion plant design. Health studies were under way in connection with plutonium production problems and a decision had been reached to build a large scale plutonium plant at Hanford and a pilot plant for plutonium study at Clinton. Meanwhile, the President's Military Policy Committee had been appointed, with General L. R. Groves in executive charge. Mallinckrodt was making purified uranium oxide on a large scale, Harshaw and Du Pont were using it for purified UF_4 and Westinghouse and a group under F. H. Spedding at Iowa State were working on pure metal production.

Where the end of 1942 had been a time of decision throughout the uranium project, 1943 was the year of building. In the spring the bomb laboratory under J. R. Oppenheimer started work at Los Alamos. Work on the Princeton isotron separator was dropped, although successful, to concentrate on the building of the calutron plant at Clinton. By midyear ground was being broken at Hanford for the first plutonium pile and construction was under way at Clinton on the gaseous diffusion and calutron plants. First units of the latter were operating by November, in which month construction of the Clinton plutonium pilot plant was started. Carbide & Carbon Chemicals had been chosen to operate the gaseous diffusion plant designed by Kellex, and J. A. Jones Construction Co., to build it. Tennessee Eastman had been selected as the calutron plant operator, and Stone & Webster as its builder. Du Pont was both builder and operator of the Hanford plant. The Army's cryptic "Manhattan District" was now in charge.

Much of the construction was completed in 1944. The calutron electromagnetic plant was already in large-scale operation, further improved in the Fall by the building of a concentrating plant for its raw material, based on the thermal diffusion process. The Clinton experimental plutonium pile and recovery plant were showing results; and the first Hanford production pile went into operation, followed shortly by the second. Work was still in progress on the gaseous diffusion plant.

As the world well knows, 1945 was the year of fruition. The third Hanford pile was completed in the spring, while the gaseous diffusion plant was operating successfully by summer. The bomb laboratory had meanwhile done its work well, as may have been suspected by those within more than a hundred-mile radius of the Los Alamos proving ground on the fateful morning of July 16. When, on August 6, President Truman's dramatic announcement told of what had happened a day previously at Hiroshima, the work of many thousands of scientists, engineers and artisans had in one sense been completed. In another and perhaps more significant sense, that work had only started.

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age kinetic energy, so the lighter necessarily have the greater average velocity.

However, the separation factor is proportional to the square root of the ratio of atomic weights and it was shown that a cascade having perhaps 4,000 stages or even more might be needed to produce 99 percent pure hexafluoride of U-235. Furthermore, the barrier problem was well nigh insuperable, requiring many acres of barrier for the required capacity, the myriad holes of which were no larger than 0.01 micron. Many barriers were developed and tested with the assistance of numerous industrial concerns and the best design, in fact, was not decided on until the plant was ready for partial operation. Almost as difficult was the problem of pumps. Diffusion cell design is so figured that half the gas pumped into each stage diffuses through the barrier while the other half, having been impoverished, is returned to the feed of the next lower stage. Thus, the barriers of the first stage may have to handle as much as 100,000 times as much gas as those of the last. Furthermore, since the half that diffuses drops considerably in pressure, several pounds at least, and even the other half loses some pressure, all flow between the many stages must be handled by pumps, very special designs of which are required to insure against all leakage, corrosion, and contamination of the process gas by sealing materials or lubricants.

With the decision to build the gaseous diffusion plant at Clinton, plans were completed by Kellex Corp., under P. C. Keith, during the Spring and Summer of 1943. Construction on the huge U-shaped group of buildings (each side of which is 2,450 ft. long, averaging 400 ft. in width and 60 ft. in height) was started by J. A. Jones Construction Corp. on Sept. 10, 1943. Operation of the first units, under Carbide & Carbon Chemicals Corp., commenced on Feb. 20, 1945. At peak production the operating force is about 12,000. In addition to the nearly 6,000,000 sq. ft. in the main building group, there are 70 other buildings bringing the total area to 600 acres. Included is the 600,000 sq. ft. "conditioning building" where certain of the equipment is conditioned before installation. This was designed and built by Ford, Bacon & Davis.

Final successful operation of the entire plant in the summer of 1945, with consistent and reliable results and better performance than had been expected, culminated almost six years of continuous effort. The highest praise for their courage and perseverence is due to all who had a part in the development.

Electromagnetic Plant—The inspiration for the electromagnetic methods of isotope separation came from the fact that the mass spectrograph (*Chem. & Met.*, Sci. Inst. Report, p. 124, July 1945), had proved in the past to be the best method for separating many types of isotopes on an extremely small scale for relative abundance determinations. It effects an almost complete separation with small hold-up and a short start-up time. A suitable com-

Almost all plants at Oak Ridge are of tremendous size

pound, in gaseous form, is introduced into an ion source (such as a region of low pressure where the molecules are bombarded with electrons to produce ionized fragments). An electrostatic field accelerates the ions through a pair of slits and an electromagnetic field causes them to move along semi-circular paths. Finally a collector of some sort is supplied for detecting or separating the quantities that have moved along paths of different radii. All ions are given practically the same kinetic energy, many thousands of times as great as their average thermal energy, so that the lighter ions, having less momentum than the heavier, move in semi-circular paths of smaller radii.

There was, however, a long road to follow from this instrument to a machine capable of separating grams, rather than micrograms. Several methods differing considerably from the one described were attempted, including the isotron method of "bunching" ions, developed at Princeton, the magnetron and so-called ionic centrifuge. For one reason or another these were dropped eventually in favor of the University of California calutron which is similar to the mass spectrograph in principle. E. D. Lawrence, at Berkeley, decided to rebuild the 37-in. California cyclotron into a giant mass spectrograph. Success was such that an uncompleted magnet for a much larger cyclotron (184 in. pole diameter, 72 in. gap) was hastily completed and applied to the calutron. In the early days it appeared that space charge in the neighborhood of the positive ion beam would be troublesome, but means were found for nullifying it to a considerable extent. Also it was possible to maintain more than one ion beam in the same magnetic field and it became feasible to widen the collector slits for capacity increase, without sacrificing sharpness of focus, by controlling magnetic field configuration. Even so, it was recognized that many separator units would be needed for a production plant. In September 1942 it was recommended that such a plant be built at Clinton. The first unit was completed in the Fall of 1943.

FEED CONCENTRATION

To avoid limiting capacity, the final design does not attempt to complete separation in a single stage. Another means of increasing capacity was to use a feed containing somewhat concentrated U-235. To double the feed concentration, for example, would enable a calutron that produced 1 g. per day of 40 percent U-235 to produce 2 g. of 80 percent material. To provide such a concentrated feed a plant based on the method of thermal diffusion in liquid, developed at the Naval Research Laboratory by P. H. Abelson, was built at tremendous speed in the Clinton works during the late summer of 1944. Thus, although the research work on the gaseous diffusion method had started at a considerably earlier date, the calutron plant was in operation almost a year sooner.

The calutron electromagnetic plant, comprising 270 buildings, is now 2 miles long and covers 500 acres. Built by Stone & Webster Engineering Corp. from equipment produced in the main by General Electric, Westinghouse and Allis-Chalmers, it is run by Tennessee Eastman with an operating personnel totaling 24,000. Serving this plant, the thermal diffusion concentrating plant includes 20 buildings, the largest 525 ft. long, 75 ft. wide and 82 ft. high. Completed in five months, its first unit was operating only three months after ground was broken. Operating personnel is in the neighborhood of 2,000. This concentrating plant was built by H. K. Ferguson Co. and is operated by a Ferguson subsidiary, Fercleve Corp.

How Hanford Solved the Problem of Synthesizing an Element

JOHN R. CALLAHAM
Associate Editor, Chemical & Metallurgical Engineering
San Francisco, Calif.

PEARL HARBOR day found this writer in the Chemical Warfare Service plant at Edgewood Arsenal, where bewildered and defensive wardens were being shown how to shield themselves with a chair and squirt water on magnesium incendiary bombs. Three and one-half-years later, announcement of the Japanese surrender found him in the awesome atomic bomb plant at Hanford Engineer Works. From magnesium incendiaries to atomic annihilation —such has been, in brief, this nation's progress in the technology of warfare within a short four years.

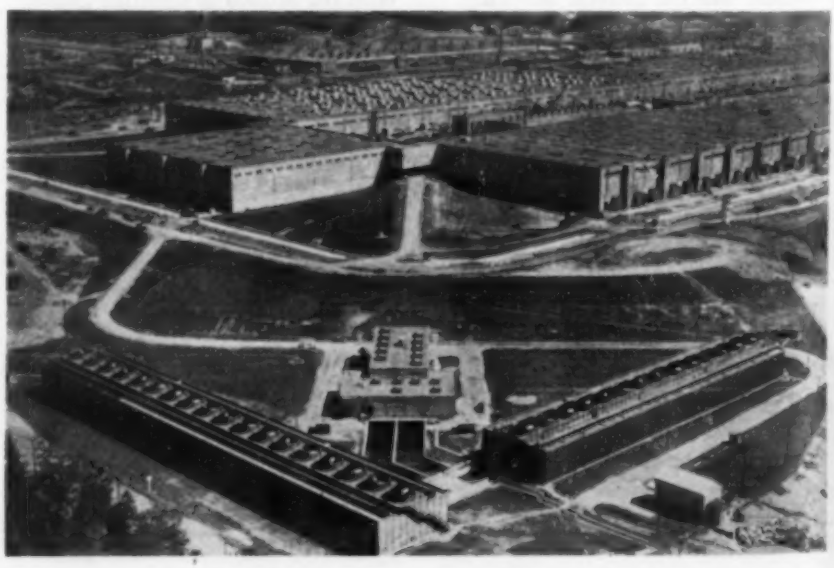
Hanford Engineer Works, located near Pasco between the Yakima Range and the Columbia River in the state of Washington, is one of the two plants in the world producing explosive material used in the "atomic" bombs dropped upon Japan. Factors that led to the selection of this particular site were the availability of large amounts of water, abundant power, cheap land, and isolation. Expenditures at the Hanford project to date are reported to have been $383,401,000, of the nearly $2 billion appropriated by Congress for the entire atomic energy project. Hanford has been designed, constructed and operated for the Army by the Du Pont company.

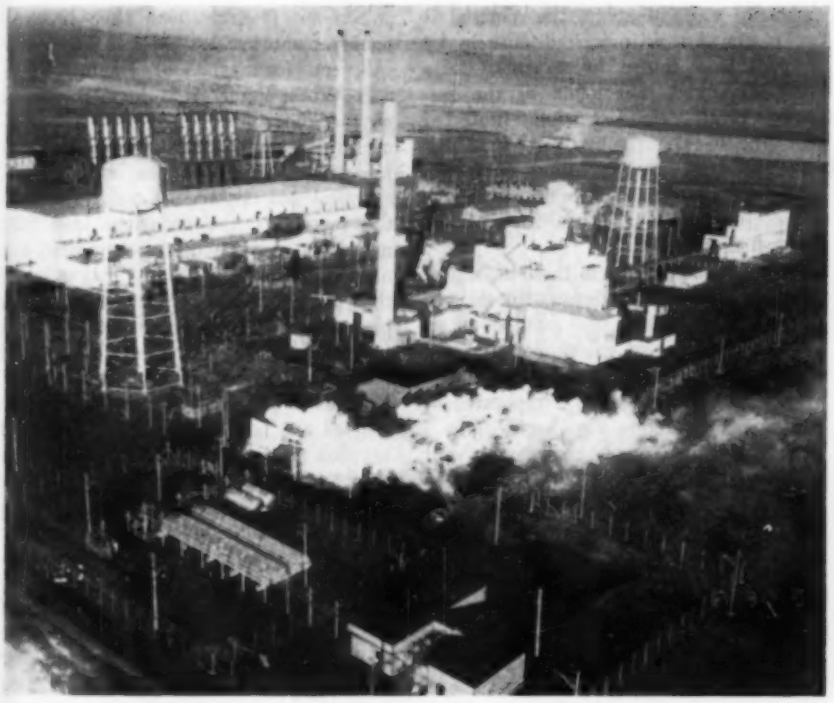
Final links in the atom-splitting process used at Hanford were discovered during the spring of 1941. Ground for the project was broken during early 1943; the first plant production from uranium slugs of its product, plutonium, began during the autumn of 1944. Since that time the plant has been in more or less continuous operation. Happily, the process worked at the first try-out and at the time of the Japanese surrender, the production rate was surpassing all earlier expectations.

ATOMIC ENGINEERING

This plant, comprising seven major manufacturing units spread over an area of more than 400,000 acres and employing some 5,200 workers, was designed and built on data obtained by microchemical

Another view of the enormous plant on the preceding page





One operating area in the plutonium plant at Hanford, Washington

studies involving only half a milligram of plutonium! Solely on the basis of these "bits of nothing," the huge chemical plants were reportedly designed on a scale 10,000,000,000 times larger.

The fact that there has been practically no major changes in equipment or processing procedure, even after such an astronomical scale-up in operations, definitely brands both research and engineering work as outstandingly sound and competent. That there have been no fatalities from operations of the plant (the entire project has had only 16 fatal accidents, all irrelevant to the process) speaks of a safety engineering job perfectly performed. Just as the entire Manhattan Project can lay claim to being the most stupendous example of cooperative research in the history of science, so the materialization of the Hanford and Oak Ridge plants undoubtedly represents the biggest and most daring accomplishment in the annals of industrial engineering. Few of the nation's leading design, construction, equipment, engineering or chemical firms did not play some important part in the development.

Magnitude of the construction job is shown by the fact that the town of Hanford, now abandoned, once housed some 51,000 construction residents. Richland, a synthetic town 15 miles from Pasco, now has a population of 17,000. Excavation for the project amounted to 25,000,000 cu.yd. of earth; more than 780,000 cu.yd. of concrete were placed. Some 345 miles of permanent plant roads were constructed on the site. A total of 40,000 carloads of materials was received for the project and, excluding rail and special steels, about 40,000 tons of steel was used in building construction. More than 8,500 major pieces of construction equipment were used; refrigeration equipment alone probably amounted to over 1,000 tons capacity.

BASIC PROCESS

In brief, the process in use at Hanford creates a new element known as plutonium (number 94, atomic weight 239) by bombarding uranium 238 with slowed-down neutrons from the disintegration of the 235 isotope of uranium. Plutonium is the end product of the plant and is one of the two explosive elements that can be used in the atomic bomb. The other, of course, is U-235 itself. The processing steps fall into three categories: (1) Fabrication of uranium metal so that plutonium can be produced; (2) production of the plutonium under very exact physical conditions; and (3) chemical separation and purification of the plutonium from the mass of inert and unconverted uranium and other elements resulting from the fission of the 235 isotope.

Primary raw material for the plant is uranium ore, ordinarily mined throughout the western states and especially at Great Bear Lake in Canada. The ore is concentrated and purified at various other locations and the raw material actually received at Hanford is metallic uranium. The beneficiation of the uranium ore alone is a complicated process (see *Chem. & Met.*, pp. 178-180, July 1943).

Ordinary uranium consists of the three isotopes 234, 235 and 238 in proportions of about 0.006 percent, 0.71 percent and 99.28 percent, respectively. For practical purposes, the 234 isotope can be forgotten. Radioactive U-235 is the key to the Hanford process, for this isotope disintegrates to produce, among other products, neutrons. These not only touch off other U-235 atoms to maintain the reaction, but also bombard the atoms of U-238. Whenever they are slowed down sufficiently by passage through a graphite "moderator," some of them are absorbed in the nucleus of the U-238 atoms to produce neptunium (element 93). This element is unstable and is quickly converted into plutonium, which is relatively stable under controlled conditions.

In the metal preparation unit, the first step in the Hanford process, metallic uranium (mixture of 234, 235 and 238 isotopes), as received at the plant, is fabricated into the proper geometrical size and shape and inclosed in hermetically sealed aluminum jackets. This procedure must be carried out perfectly since a flaw in the seal could possibly close down the entire Hanford works. The fabrication of metallic uranium has, of course, necessitated development of an entirely new and unorthodox field of metallurgy. One unit fabricates all the uranium to feed the rest of the project.

In the second step, these slugs of uranium are stacked into a definite geometric pattern in a pigeon-holed graphite "moderator" of controlled shape, size and thickness. These plants, of which there are three identical in design and capacity but separated from each other by distances of about five miles, are known as the "pile plants." The purpose of the geometric piling is to intensify, through mass action, the conversion of U-238 into plutonium by neutron bombardment from disintegrating U-235. The graphite "moderator," as mentioned, serves to slow down the neutrons to suitable speeds for U-235 fission and neptunium formation, but yet does not absorb them. In addition to the graphite and uranium slugs, the pile contains the necessary instruments and carefully placed absorbers to control the operation by absorbing some of the neutrons.

Specifications on the size, shape, and arrangement of the uranium slugs and the graphite moderator are among the most critical factors in the entire plant. They will probably remain the most closely guarded secret of the Hanford process.

Owing to various factors, including impurities in the uranium, incompleteness of this relatively slow reaction (due to its reversibility after a certain stage has been reached), and the loss of unabsorbed neutrons, the concentration of plutonium in the uranium mass probably never becomes greater than a few grams per ton. Numerous fission products are also included in the reacted mass.

Since the materials in the pile plants are intensively radioactive, all storage and handling must be done behind thick concrete walls or lead shields. The material is never seen, and all operations are auto-

matically controlled by a foolproof remote control system especially designed for this purpose. Operations in the pile plants are purely mechanical.

When U-235 disintegrates into barium and krypton, one of a number of possible disintegrations, some matter is transformed into energy. Therefore the over-all heat generated from the piles is terrific and must be removed through use of large volumes of cooling water from the Columbia River or probably, during the summer months, by giant refrigeration systems. This heat, released (according to the Smyth report) at a rate equivalent to 500-1,500 kw. per gram of plutonium produced per day, is said to be sufficient to raise the temperature of the Columbia River to a slight extent. Naturally, many problems in heat transfer, as well as methods of handling the radioactive water, were encountered. In all probability, the heated water could be handled in ordinary steel equipment, but it should be deactivated before being sent back to the Columbia. This step might be accomplished by the aid of a series of towers somewhat resembling fractionating columns. Each pile unit has 10 such towers. It is evident that potential problems of this character have actually been circumvented by exhaustive research and development, combined with a high degree of skill in design, construction and operation.

CHEMICAL PURIFICATION

The product from the pile plants consists of slugs of metallic U-238 containing a very small amount of plutonium and numerous fission byproducts. This material goes to one of three widely separated chemical treating or purification plants where the plutonium is removed and concentrated from the mass of uranium. Actually the only chemical phase of the Hanford process, this involves new chemical engineering principles and practice. Naturally, a large volume of different chemicals must be used to obtain even a pound of pure plutonium. Just what chemicals are used and the sequence of the operation is another key secret to the process. However, the Smyth report suggests that the method may be one of coprecipitation with a carrier, probably involving alternate oxidation and reduction.

Buildings for these chemical units are almost solid concrete to protect both personnel and processing materials from radioactivity that might otherwise prove disastrous. Each of the three units is approximately 880 ft. long, 80 ft. wide and 60 ft. high, with foundations 35 ft. deep. The actual working floor space is much smaller. The plutonium is necessarily handled in small quantities by the very nature of the process. This also avoids any possible explosions, since the element is not explosive unless relatively large masses are brought fairly close together. Periscopes are occasionally used; otherwise the material is never seen but is processed entirely by special remote control instruments.

Workers and inhabitants of the surrounding areas are successfully protected from the associated radioactivity by elaborate precautions in the form of special instruments and medical examinations, by engineering design and construction, and by operating procedures.

Chemical equipment in these units is of more or less orthodox design, but the materials of construction and methods of remote control are so unorthodox as to be unique to this one plant. Corrosion—regular chemical corrosion complicated by "nuclear" corrosion—has been quite a problem. Hence much engineering work had to be done toward developing materials of construction that would be resistant to "nuclear reactions."

End product of the purification plants is plutonium. In addition, there are some interesting waste products, one of which is the radioactive exit gases. These are diluted with atmospheric air in vast quantities through the use of high exit stacks. Operation of this particular step is coordinated with weather conditions to insure proper dispersion. If atmospheric conditions are not proper, this treating unit is closed down as a protective measure for the entire area. Liquid effluents, also radioactive, are being run into huge sunken storage tanks until methods can be worked out for final utilization or safe disposition. The urgency of producing plutonium for atomic bombs did not allow time or effort for solution of such secondary problems. In comparison to the job already done, the answers should not be difficult to find.

Large quantities of byproduct uranium 238, contaminated with incidental fission products and largely depleted of its 235 isotope, also demand attention. As yet, methods of utilizing this spent or partially-spent uranium remained to be worked out. The end product of Hanford, the element plutonium, is shipped to the bomb assembly plant in New Mexico.

Several features about Hanford Engineer Works immediately brand it as one of the outstanding industrial and engineering accomplishments of all time: (1) Its new and unorthodox metallurgical, chemical and engineering techniques; (2) the success of the audacious leap from microgram experiments to engineered tonnage operations; (3) a production record that has exceeded all expectations; (4) a perfect safety record under the most dangerous processing conditions known to industry. Toward the immensity and ramifications of the entire project, a large portion of the nation's industries have contributed unstintingly. Unprecedented cooperative effort among operators and workers, supervisors and scientists, industry and the Army, engineers and construction crews, has produced in turn an unprecedented success.

Some of the key production personnel the writer met on this trip included Col. Franklin T. Matthias, commanding officer; Maj. Joseph F. Sally, chief of production; R. E. Hageman, technical assistant to Maj. Sally; Capt. R. E. L. Stanford, representing the Army in the metal preparation plant and part of the chemical purification units; Maj. F. A. Valente, representing the Army in the plutonium production area and the remainder of the chemical purification units; Walter O. Simon, plant manager for DuPont.

The author wishes to express special appreciation to Lt. M. R. Cydell, public relations officer, who issued the invitation and made the trip possible, and to Capt. R. E. L. Stanford, who personally conducted the tour throughout the plant area and supplied much basic technical information. The statements made in this article do not necessarily reflect the opinions or comments of any person connected with the Hanford or Manhattan projects, but are solely the responsibilities of the author.

Operating area of previous view, shown from opposite side

LIONEL S. GALSTAUN *Research & Development Dept., Tide Water Associated Oil Co., Avon, Calif.*

ISOPENTANE

Produced by Liquid-Phase Isomerization

Isopentane, now vitally important to our high-octane aviation gasoline program, has promise as an ingredient in postwar premium motor fuels. Isomerization of low-octane pentanes from natural gasoline may represent one way of up-grading these paraffins into more valuable gasoline constituents. The Tide Water pentane isomerization unit described in this article is the first commercial plant.—*Editors*

Since the latter half of 1944, Tide Water Associated Oil Co. has operated at its Avon, Calif., refinery, a liquid-phase pentane isomerization plant of the Shell type. Mechanical design was by C. F. Braun & Co., Los Angeles, and operation is under license from Shell Development Co.

The plant is essentially similar to the liquid-phase butane isomerizers using antimony trichloride as a catalyst carrier which have been in commercial operation for about two years. As usual in early operations of a new process, some mechanical changes in the original plans were necessary both in design and operating technique. These changes put the process into successful commercial operation.

This unit, the first commercial plant of its type, converts normal pentane to isopentane. A yield of 50-60 liquid volume percent isopentane is obtained on a once-through basis. Side reactions are normally so slight that about 97 percent yield can be obtained by recycling unconverted normal pentane. The flow is continuous both as to hydrocarbon feed and catalyst make-up.

Active catalyst employed is anhydrous aluminum chloride, together with about 5 mol percent of anhydrous hydrogen chloride (on the basis of hydrocarbon feed). The aluminum chloride is carried as a solution in molten anhydrous antimony trichloride.

Solutions of aluminum chloride in antimony trichloride exhibit a single eutectic at 7.5 weight percent aluminum chloride which melts at about 153 deg. F. The catalyst mixture may contain 0.5-2.0 percent aluminum chloride; the freezing point of such mixtures is approximately between 160 and 164 deg. F. As a consequence, the catalyst in the plant is always maintained at a temperature considerably above this range.

In the isomerization of pentane, disproportionation or cracking occurs with an uninhibited catalyst. Hydrogen is used as a cracking suppressor. It is supplied to the reacting mass in sufficient quantity to maintain a partial pressure of about 60 to 70 lb. per sq.in.

The flow diagram gives the essential processing vessels. Normal pentane enters at the left and is pumped through dryers since feed stocks obtained from storage tanks may be saturated with water. While this water content is small, the effect is that increased consumption of aluminum chloride or plugging of the catalyst scrubber column may result. Dual activated aluminum dryers are used, one being on stream while the other is being regenerated.

PROCESS DESCRIPTION

After passing through the dryers, the feed enters a preheater where the temperature is raised to within 20 or 30 deg. of the reaction temperature. The reaction supplies the remainder of the heat. From the preheater, the dried feed runs to the bottom of the catalyst scrubber column where antimony trichloride and free aluminum chloride are countercurrently extracted from the reject catalyst stream entering at the top of this column.

The pentane stream, which now contains recovered antimony trichloride and aluminum chloride, flows to the contactor where it is subjected to isomerization conditions. On the way, it passes through a manifold where recycle hydrogen, HCl and antimony trichloride are injected as well as make-up aluminum chloride carried in antimony trichloride. The mechanism by which these recycle streams are first separated and then returned to the process will be discussed.

The contactor is equipped with a mixing device and the contents are kept well agitated. As stated before, the reaction temperature is about 200 deg. F., the pressure 300 lb. per sq.in. Under these conditions the reacting mass is maintained in substantially a liquid state. Above the level of the mixture and within the vessel itself is a baffle. Liquid above this baffle is quiescent and undissolved catalyst separates out as a dense phase. Slots in the baffle permit return of this settled catalyst to the turbulent zone.

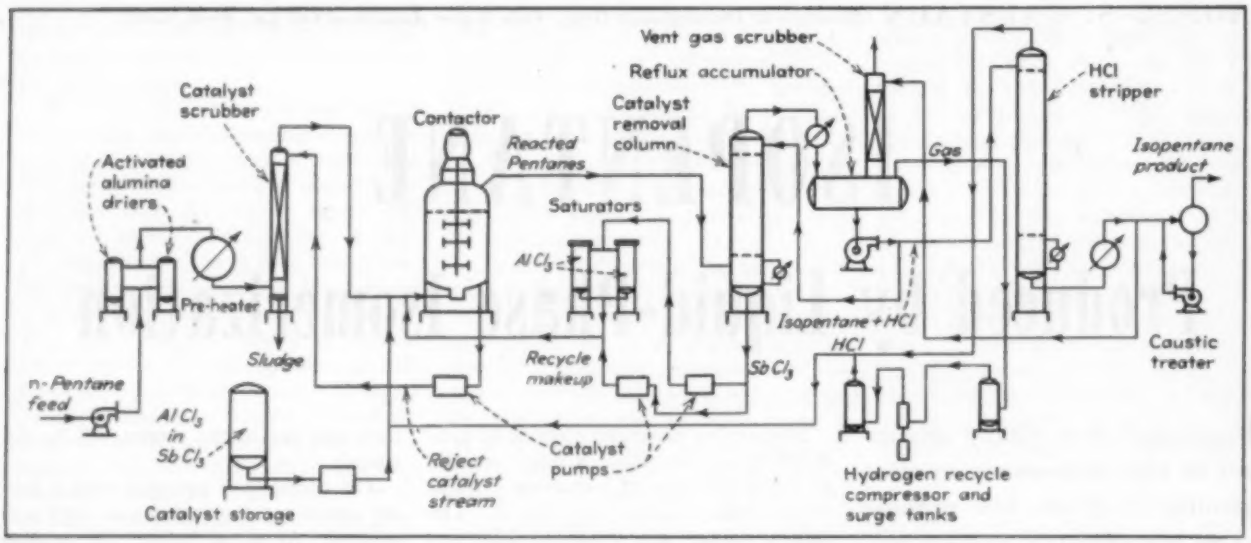
In normal operation, a small amount of aluminum chloride-hydrocarbon complex is formed. This complex is essentially inert as an isomerization catalyst; it is also substantially insoluble in pentane.

CATALYST REMOVAL

In order to prevent accumulation of the inert complex in the contactor, a small volume of catalyst (called the reject catalyst stream) is pumped from the contactor to the top of the catalyst scrubber column. Here antimony trichloride and active aluminum chloride are countercurrently extracted from the catalyst by preheated pentane feed; the inert complex or "sludge" remains as an insoluble liquid residue which is periodically withdrawn from the bottom of the catalyst scrubber column.

Reacted pentane mixture, saturated with antimony trichloride and aluminum chloride and containing hydrogen and HCl, passes to the catalyst removal column.

In this column, the mixed pentanes, hydrogen and HCl are distilled off as overhead product while antimony trichloride containing a small proportion of aluminum chloride is separated as bottoms. The catalyst column is equipped with a reboiler containing a surge chamber for the antimony trichloride. From this surge chamber, the catalyst recycle pump and the catalyst make-up pump take suction. The bulk of the antimony trichloride is returned directly to the contactor by way of the catalyst recycle pump. A small stream is pumped by the make-up pump



Flowsheet showing liquid-phase pentane isomerization at the Tide Water Associated Oil Co., Avon, Calif.

through the saturators where the antimony trichloride dissolves aluminum chloride to supply make-up to the contactor. After passing through the saturators, the stream combines with the catalyst recycle stream and returns to the contactor.

The saturators are a dual unit, and comprise two steam-jacketed pressure vessels. They are filled with anhydrous aluminum chloride, one saturator being on stream while the other is recharged.

CONTROLLED MAKEUP

Rate of aluminum chloride make-up is controlled by the rate of the make-up pump. This rate is set to maintain the aluminum chloride concentration in the contactor as required to obtain a satisfactory conversion.

Due to the large difference between the vapor pressures of the catalyst components and pentane, the catalyst removal column has only ten trays and is operated at a reflux ratio of only 0.25 on the overhead. This is amply sufficient to obtain a clean separation between antimony trichloride and pentane.

The overhead portion is partially condensed and the condensate is held in a reflux accumulator. Reflux for the catalyst column is obtained from the liquid in this tank. The bulk of the gas is recycled to the contactor by the hydrogen recycle compressor. The remainder is vented through a small vent-gas absorber where hydrogen and light hydrocarbons are removed from the process and HCl and the heavier hydrocarbons retained. The light hydrocarbons are formed in small quantities as side products of the isomerization reaction and must be removed to prevent accumulation and a resultant pressure rise. The rate of venting is set to hold the pressure on the catalyst removal column within the controllable range. Cooled HCl-free product (obtained from the HCl stripper column bottoms) is used as "absorption oil." The bulk of the HCl is recovered from the vent gas by this means.

Accumulator liquid, comprising isomerized product and HCl, is pumped to the HCl stripper. In this column, HCl containing a small proportion of hydrocarbon is separated as an overhead product. This stream, in its entirety constituting the HCl recycle, is returned to the contactor. The bottoms are cooled and caustic washed. This stream constitutes the entire plant-product.

Operating surge for HCl is obtained in the HCl stripper. This column has 20 trays, and roughly the upper half is used as a surge tank for HCl. In this portion, the temperature is relatively low and the liquid holds sufficient HCl to absorb normal operating fluctuations in HCl flow. Below the surge portion the temperature rises sharply, indicating that the hydrocarbon is being denuded of HCl. By means of thermocouples on the trays, it is possible to determine how much of the column is available for HCl surge. Loss of HCl from the system is indicated by a rising level of the temperature "break." When this "break point" comes close to the top of the column, more HCl is added to the system.

PROCESS CONTROL

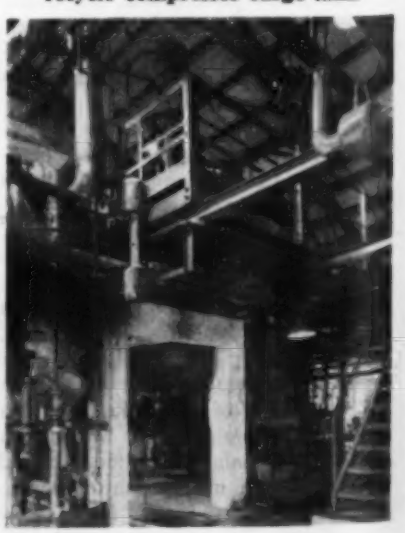
The important process control variables are: (1) The temperature of the contactor, (2) concentration of aluminum chloride in the catalyst, (3) concentration of HCl, (4) volume of hydrogen recycled to the contactor and (5) the concentration of inert hydrocarbon-aluminum chloride complex in the catalyst. The latter is not as critical as the others but should be kept as low as possible. All of these are determined by chemical analyses together with metered flows in some cases.

Rise in temperature on isomerization is an excellent means of checking the extent of the conversion and provides a continuous operating check on the plant. The isomerization of normal pentane to isopentane at 25 deg. C. and 1 atm. pressure releases 37 B.t.u. per lb. of normal pentane undergoing reaction. Under operating conditions, the heat of reaction is approximately the same. This release of energy heats the entire stream including hydrocarbon feed, catalyst, HCl and hydrogen. The inlet temperature is therefore measured after all recycle streams have entered the manifold.

Theoretically, the final temperature should be taken at the outlet of the contactor. Practically, because of efficient mixing, the temperature in the vessel itself is sufficiently close to the outlet temperature to be used as such. This is held close to 200 deg. F.

As stated before, the concentration of free aluminum chloride in the catalyst is maintained at a value between 0.5 and 2.0

Saturator, contactor (center), and recycle compressor surge tank



Catalyst storage tank and melter (anhydrous $AlCl_3$ dissolved in molten anhydrous $SbCl_3$)

percent. Higher concentrations tend to cause cracking and low concentrations result in insufficient conversion.

Concentration of HCl is best measured in the overhead of the catalyst column. The method consists in passing a vapor sample through a measured volume of standardized alkali in a graduate submerged in cracked ice or liquid normal butane; phenolphthalein is used as indicator. At the color change, the flow of vapor is stopped and the volume of condensed pentane is read on the graduate. From the known volume of standard alkali and the measured volume of pentane, the HCl concentration can be readily calculated.

The volume of hydrogen entering the contactor must be sufficient to maintain a partial pressure of more than 60 lb. per sq. in. This partial pressure is not measured directly but can be reduced by calculation to a volume rate of hydrogen. If the hydrogen content of the hydrogen recycle stream is known, the volume can be adjusted to maintain a sufficient quantity. Hydrogen is continually lost from the system through venting of light ends resulting from side reactions. Therefore, it is necessary to maintain a continuous make-up of fresh hydrogen to supply the loss.

HYDROGEN CONCENTRATION

Too much hydrogen can suppress isomerization. Hence, in good operation, a balance is struck between the amount required to prevent cracking and the excessive quantities which suppress the desired conversion.

Concentration of the aluminum chloride-hydrocarbon complex in the catalyst should be kept to a minimum. This complex is highly corrosive to steel, especially in the presence of HCl; furthermore, the "inertness" of the complex refers only to isomerizing activity. It is not chemically inert and if allowed to remain too long in the plant, continued reaction increases its viscosity and may eventually cause polymerization to a solid. When this happens, the disposal of the complex becomes difficult.

Other variables which affect conversion are the contact time, phase ratio of catalyst to hydrocarbon in the contactor and the degree of mixing. The phase ratio is customarily about one. The other factors are more or less fixed by the design and feed rate.

CORROSION FACTORS

No corrosion protection is required in vessels and lines in pentane service. Where pentane, catalyst, complex and HCl must be handled together, carbon steel is satisfactory except in locations where turbulent conditions exist, or in equipment such as motor and block valves where no corrosion is tolerable. The contactor is an example of a turbulent zone and nickel-clad steel provides ample corrosion protection. All valves in catalyst service are of Hastelloy trim. In HCl-pentane service, carbon steel is entirely satisfactory and design is no different than for similar services in butane isomerization.

Thermal or mechanical stresses in steel used for catalyst service generally cause an aggravated corrosion. Thus, stress relieving of large vessels or pipe in catlyst service is standard practice.

SPECIAL FEATURES

Since the catalyst melts above normal atmospheric temperature, special precautions must be employed in its handling. All catalyst lines, for instance, must be kept heated. This is done by steam tracing between the heat insulation and the line. Vessels containing catalyst are steam jacketed. The jackets on operating vessels are used only when the plant is shut down. An exception to this is the surge chamber on the catalyst column reboiler where flow is small and cannot be depended upon to supply sufficient heat to keep the mass melted. The catalyst storage tank, on the other hand, is kept heated continuously.

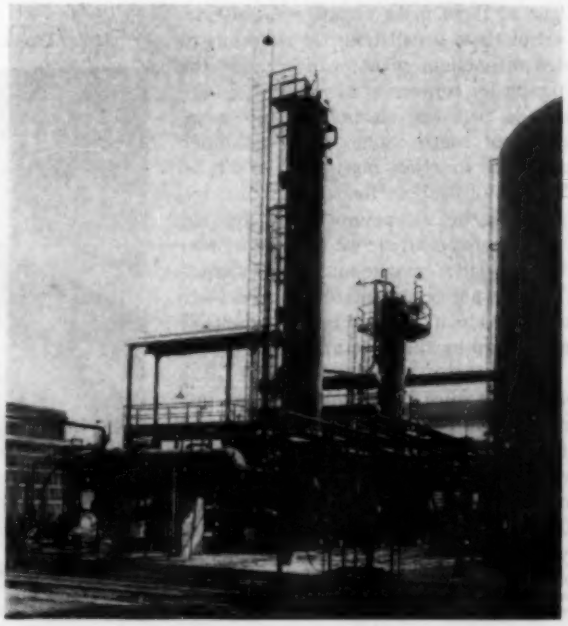
Melting of make-up antimony trichloride is accomplished within the plant, without external handling of the material. The melting is done in a small, steam-jacketed vessel, connected to the catalyst storage tank. The elevation of the melter is such that melted catalyst will flow by gravity into the storage tank. The connections from the melter to the catalyst storage tank include a bottom line for delivery of melted catalyst and an upper pressure equalizing line. The melter is of sufficient size to hold two drums of antimony trichloride. The drums are first perforated and hoisted into the melter. The vessel is then closed and the steam turned on. About four hours is sufficient to melt a charge. When the charge is melted, the melter is blocked off from the storage tank, vented, opened and the empty drums removed.

Operational experience over several months has demonstrated that the process is technically sound although control is more critical for pentane operation than for butane. Continuous runs of several months duration have been successfully accomplished with remarkable economy of chemicals. Aluminum chloride usage has been lower than estimated, hydrogen somewhat higher. Antimony trichloride losses, usually due mainly to handling, show rather large fluctuations.

Certain important operating and design details are beyond the scope of authorized publication at this time. It is frankly admitted that these have not been reported here, although such information will be made available to properly authorized parties.

The author acknowledges the assistance of Shell Development Co. in making available in advance of publication a preprint copy of a paper by McAllister, Ross, Randlett and Carlson entitled "The Liquid-Phase Isomerization of Normal Paraffins Using Liquid Salt Catalyst."

Isomerization unit—neutralizing system (left), HCl stripper, and catalyst removal column



R. S. McBRIDE *Editorial Consultant, Chemical & Metallurgical Engineering, Washington, D. C.*

USERS WANTED

For Caustic-Chlorine Surplus Plants

The government owns eight plants built for war manufacture of caustic and chlorine. Some are already surplus property and others soon will be. RFC is aggressively seeking users to buy or lease these properties. This article tells of the several plants, and discusses some of the complicated problems involved when industry executives deal with the government surplus officers regarding either these alkali establishments or any other surplus process industry plants and equipment.—*Editors*

OWNERSHIP or control of about a dozen plants which contain equipment for electrolytic manufacture of chlorine is vested in the United States Government. Eight of these make caustic and chlorine. Two of these installations are the units of large magnesium plants which made the chlorine for conversion of magnesia to the chloride that was electrolyzed for manufacture of metal. Some of the chlorine capacity is in other magnesium plants in the form of facilities for recovery of chlorine from the magnesium cells. For the purposes of this article we can ignore most of these latter magnesium cell facilities. They are not a part of the surplus alkali capacity which is prospectively available for disposal by the government.

Four of the government-owned alkali plants that must be considered as prospective surplus property are the installations at Chemical Warware Service arsenals, where they have been installed for the manufacture of chemical warfare gases. Only one of the plants is a commercial type of caustic-chlorine installation, the plant at Natrium, W. Va., leased by Columbia Chemical Division of Pittsburgh Plate Glass Co. Another alkali installation is a small group of cells installed at Memphis as a part of the facilities built for making phenol. It is not proper to consider this last installation as a separate alkali unit since it is useful as a part of the phenol plant. Until the government knows what it is going to do with the phenol plant, it would be unwise to discuss any other use or the removal of this alkali equipment. However, the plant's chlorine-caustic facilities may well be leased temporarily for operation, but probably will be sold only as a part of that complete plant.

INTEGRAL PLANT UNITS

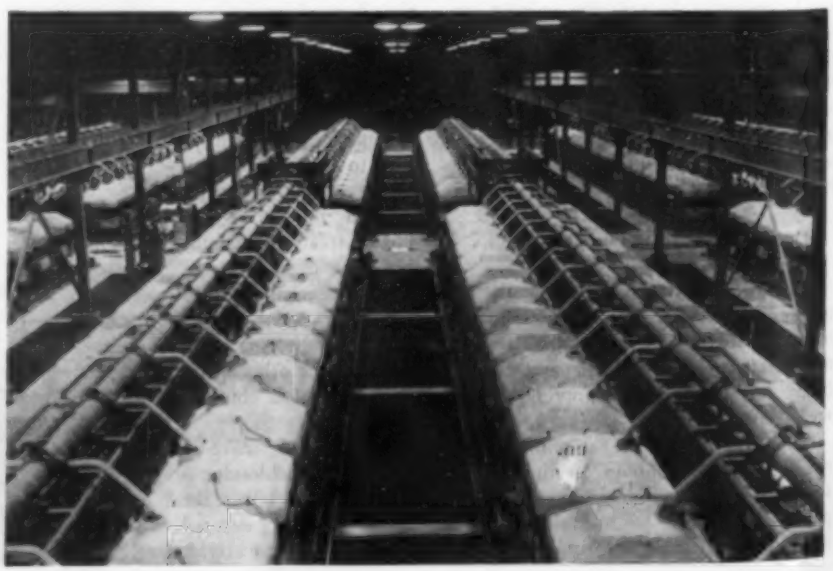
The government is not likely to let go of essential parts of any present plants until it is known that the plant as a whole is not going to have a greater value "as is and where is" than the sum of the values of the several parts if disposed of separately. This is the reason why the government already feels certain that the chlorine facilities at most of the magnesium plants must not be considered as prospectively surplus in the immediate future, except in the case of Las Vegas. That one magnesium installation has proved already so much of a white elephant that it certainly is going to be broken up or leased as prospective users are found. The alkali equipment at Velasco, Texas, remains as a part of that magnesium plant.

Government men logically believe that the disposal of surplus government facilities may be most advantageously arranged in most cases if present plants can be turned over to someone for commercial use in their present form and location. Naturally, such transfer of complete plants to private hands, either by rental or sale, would most quickly put the facilities into profit making and job creation.

Of the six alkali plants worth talking about, the one at Natrium, West Virginia, certainly is most promising for immediate commercial use in this manner. No announcement has been made whether the government expects to turn this plant over to the present operator, Columbia Alkali. But that firm has an option to buy and is believed most likely to take it over soon.

This basic question of who will get such plants is one that deserves thoughtful consideration by everyone, whether or not he

Hooker cell room, chlorine plant No. 1, at Las Vegas, Nevada



has had an operating contract. Some of the government men go so far as to say that all such plants have got to be offered to the highest bidder. Thus the present operator of an establishment would have little or no preferred position. And it does seem unlikely that mere status as an agent-operator will give *unlimited* preference to a firm now running a plant for the government, unless that firm has some such right in its contract.

LEASE VS. SALE

Uncle Sam would rather sell surplus property outright; but that is not too easy, especially under the present Surplus Property Act. In many cases, including all important chemical works, the surplus property group may not dispose of a costly plant in such fashion without both a clearance at the Department of Justice and a tacit approval by Congress. It seems likely that the Department of Justice will promptly give sales clearances on contracts where new monopoly trends are not encouraged. And SPB must wait for at least 30 days after reporting an impending sale to Congress before that sale may be finally consumated.

In many cases, including some of the alkali facilities under discussion here, operator companies have an option to buy as a part of their operating contract. Most of those options fix a method of pricing the facilities which probably would make the plants (especially recent ones) of substantially greater cost to the operators than is justified by present market conditions. Hence, it is expected that very few companies will at once exercise their option to purchase in the form provided by the operating contract.

Where complications develop in arranging for the sale of plants, it is expected that short or medium term leases may be arranged. During the lease period complicated negotiations for sale can proceed. During such period lessees also will have time to develop markets and to make sure that they really want to buy. Thus both the government regulations and the plans of the company can be worked out during the lease period.

THE MONOPOLY FACTOR

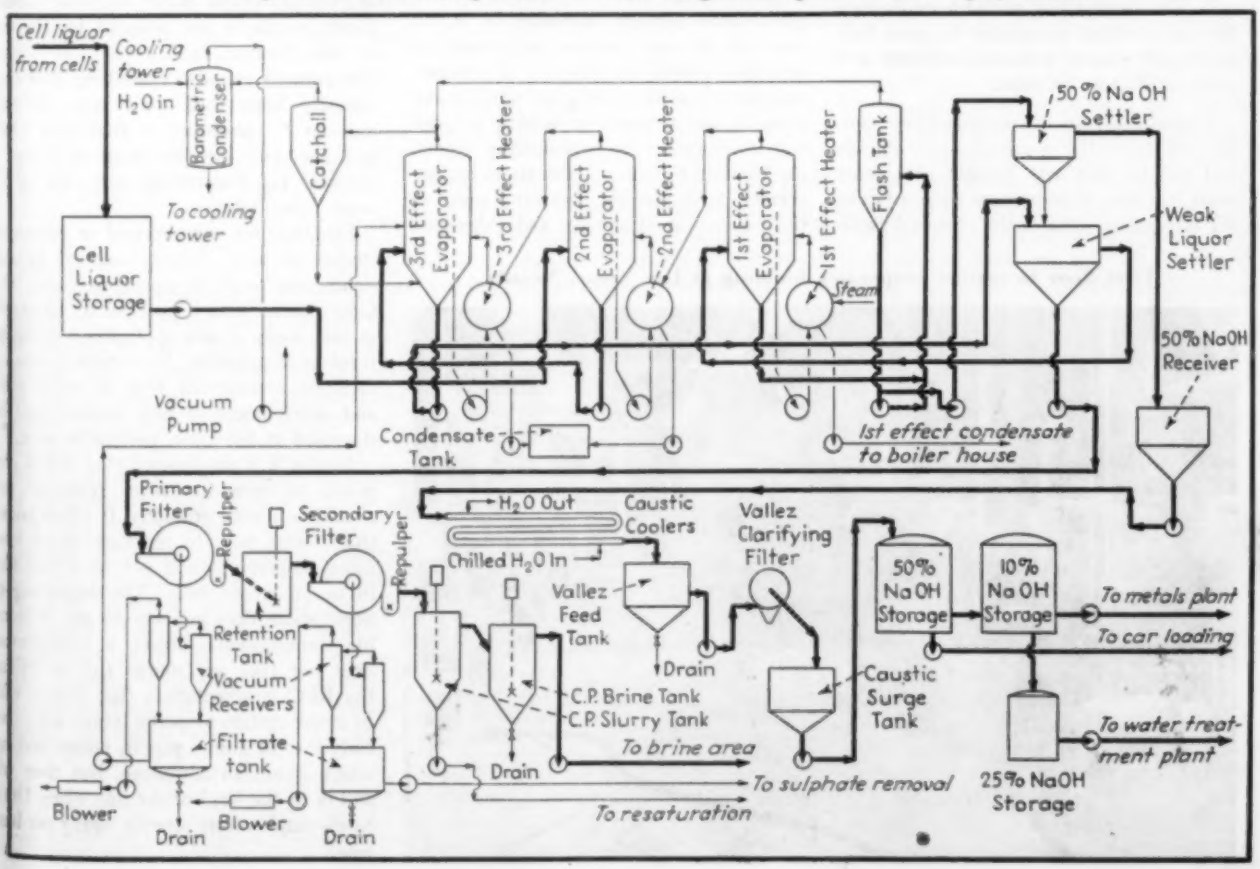
Government officials have made a careful study of the chlorine industry as it now exists and realize that no single present alkali company operates any large percentage of the electrolytic business. Thus it does not appear that the Department of Justice is likely to have any objection to the sale or lease of any reasonable portion of the surplus facilities to any one of these firms. No single firm could, by taking any one of these plants, achieve a dominating or monopoly position of any serious consequence. On the other hand, it is unlikely that one concern would be allowed to buy several or all for that would constitute too large a percentage of American electrolytic capacity for Justice officials willingly to accept.

COMPETITIVE BIDS

Officials engaged in selling surplus government facilities, or consumers' goods for that matter, have a difficult problem of disposal whenever they depart from strictly competitive bidding for the goods or plants. Even though a negotiated sale may be eminently fair to the public, there will always be a question as to whether the government men got all that they should and made the most advantageous deal. For this reason there is a growing tendency in RFC to dispose of surplus plants only by something which approximates competitive bidding (unless the war-time operating company chooses to exercise its purchase option under some earlier contract).

There is great difference of opinion on this point both within and without RFC, the sales agency. Some officers think that they can negotiate sales with single companies and depend on the fairness of such contracts to prevent undue criticism. The tendency is, however, toward the taking of bids. That does not mean that only sealed competitive bids would be considered. It means, rather, that RFC will announce the availability of a plant and indicate its desire to receive offerings for it, perhaps indicating some date before which

Flow diagram of caustic evaporation in Basic Magnesium plant at Las Vegas, Nevada



such proposals are expected. The surplus property officers would then proceed to negotiate terms and conditions with various firms making proposals.

POSTWAR PREPAREDNESS

It is evident from the summary above that Chemical Warfare Service has more than a third of the available government-owned alkali capacity. Some of that capacity will certainly be retained as a permanent part of the arsenal installations of this Service. For example, there is no doubt that the Army will insist on keeping Edgewood Arsenal ready to go. They very much want Huntsville, Alabama, also.

The other two Army arsenals having alkali facilities are badly located, relatively, from the standpoint of industrial use. It is rather unlikely that anybody will want to go to Denver, for example, to make and market caustic and chlorine. Three possibilities are therefore being considered for that installation and to a lesser degree for Pine Bluff, Arkansas. More or less in the order of preference of government men, these are:

1. The development of some new caustic and chlorine using chemical business near these arsenals.
2. The leasing of the arsenals to some firm that will use part of them for local manufacture and part of the capacity for primary products to be shipped out and sold commercially at destinations within economic freight range.
3. The dismantling of the arsenals with the sale of alkali equipment to some firm which will remove it for reinstallation at a more satisfactory location.

Preparedness for any possible future conflict will be in the minds of Army officials and will be used with Congress for some years to come. Under these circumstances the disposal of some of the chemical facilities owned by the government must take account of a readiness to serve any future emergency needs. This matter has been very carefully considered in the War Department. A definite policy has been fixed with respect to certain industrial plants. Reduced to their simplest terms these decisions seem to amount about to this:

Present facilities must continue at the command of the War Department at least until peace has become stabilized. Even after lease or sale, these Army plants must be maintained by the company controlling them so that they can be restored to efficient operation within a reasonable time. In some cases the government will contract to take for its peacetime uses a small percentage of the output of the plants, thus aiding in maintaining the business for which they are continued. The new controlling company must not only pledge itself, but must demonstrate at intervals to the Army its ability to put the plants quickly back into operation for the wanted products, in the event of emergency.

CHLORINE NEEDS

The consumption of chlorine in the United States has grown steadily for many years past. Conservative estimates suggest that the industries of America will need all of the commercially owned facilities and a substantial part of the government property to meet postwar needs for this important chemical.

It is expected that government surplus property agents will cooperate in making government capacity available by leases, especially if some sudden important use develops beyond the capacity of commercial plants. Certainly the government is not going to take a chance on holding up postwar employment by withholding operating facilities from use under those circumstances. It is possible that even some of the capacity at Huntsville and Edgewood might be thus made available for commercial operation under such circumstances, even though the Army might not have any intention of actually selling the facilities.

Some of the new chlorine demands most talked about include: Use of dichlorstyrene instead of styrene as a constituent of synthetic rubber and some plastics; greater use of chlorine for sewage treatment to prevent stream pollution; enlargement of chlorine use for water supplies in accordance with the break-point method; increased manufacture of chlorinated hydrocarbons for solvent and other uses; new manufacture of bleaching materials for the paper and textile industries; and, of course, scores of other new demands that are less prominently considered.

Only when no new uses of a plant in its present location can be found are surplus disposal officials willing to listen to proposals for dismantling and removal to some other site. In this connection it must not be forgotten that there are political factors which will raise a good deal of difficulty in the way of any proposal to move facilities. In some instances that sort of factor may be dominant in determining surplus decisions.

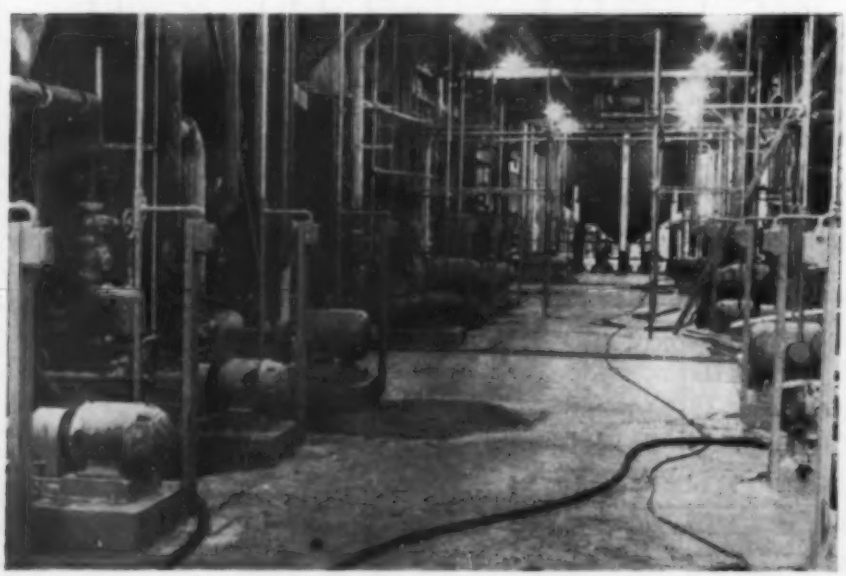
WHAT TO DO NOW

Surplus property officers are hoping that chemical engineers will act promptly in these matters. They do not want the reconversion period to be delayed for lack of prompt action. Most welcome immediately would be any proposal for the use of the chlorine facilities at Las Vegas. Government executives handling that case sincerely hope that some new chlorine use may be developed in that area. Only as a last resort do they want to accept a proposal for dismantling and removal to some other location.

Proposals for experimental or economic studies on new chlorine uses of general significance would be equally welcome. The Government is in a position to cooperate in such study of new applications of equipment and products. Short-term leases to facilitate commercial trial of such plans and development of new markets will be discussed at any time, preferably soon.

Finally it is emphasized that initial proposals of even the most tentative sort should be started promptly. If a firm knows that it may wish to purchase or to lease some property, it will not be a bad idea to be on record early. The beginning of negotiations does not require any irrevocable commitments. Hence a management does not take any undue risk by telling the RFC representatives that it may wish to secure certain property. Those who start early may be guinea pigs in policy making, which is not an advantage. But they will still be at the head of the line when Uncle Sam's surplus store actually opens for business.

First floor in caustic evaporator building at Las Vegas, Nevada



INDUSTRIAL INTELLIGENCE STAFF, CWS

Wartime Chemical Developments in GERMAN INDUSTRY

This summary of the results of recent field studies by civilian investigators was prepared under the direction of Col. H. A. Kuhn, assistant to the Chief of Chemical Warfare Service. It is based on individual reports by Gaston F. DuBois and Francis J. Curtis of Monsanto Chemical Co., William S. Calcott and Lester M. White of E. I. du Pont de Nemours & Co., Ernest H. Volwiler of Abbott Laboratories, M. F. Fogler of Solvay Process Co., Percy J. Leaper of General Chemical Co., and R. Lindley Murray of Hooker Electrochemical Co.—*Editors*

PRIOR to the landing in Normandy, Major-General William N. Porter, Chief of Chemical Warfare Service had organized a group of investigators, military and civilian, to examine German industrial developments along chemical warfare lines. While the prime interest was in finished military products, the investigations also covered new developments in the production of the component items, particularly those which would accelerate production in this country for the remainder of the war. These teams of investigators were expanded prior to V-E Day by inclusion of technicians particularly well acquainted with the prewar German chemical industry. These teams, operating under the direction of SHAEF, proceeded to collect first-hand information regarding German chemical war activities. Although this work is still in progress, a tremendous volume of data has been collected and it is hoped can be made available. The gathering together and sifting of all these reports into a form suitable for general distribution is a tremendous task and will take considerable time. In the interim, however, it has been thought advisable to present this preliminary summary covering the more important findings.

N.B. In distributing this technical information which has come into its hands from captured German territory the War Department warns that its use is at the user's own risk insofar as any United States or foreign patent violations are concerned.

1. CHEMICALS FROM HYDROGEN

The development and installation of the Haber process for manufacture of synthetic ammonia at Oppau prior to 1914, utlizing hydrogen from coal and water and nitrogen from the air, made it possible for Germany to fight World War I. Utilization of these same raw materials in the manufacture of ammonia for fertilizer and explosives and in the manufacture of liquid fuels again proved indispensable to Germany in the recent war. By the late twenties, Germany had built up a fixed nitrogen capacity which, according to published figures, was in the neighborhood of 1,000,000 tons of nitrogen annually. About 75 percent of this capacity was centered at the I. G. plants at Leuna and Oppau working on brown coal and coke. The other 25 percent was located mainly in several Ruhr plants, working on hydrogen from coke-oven gas. It appears that the Germans believed that this capacity was adequate at the start of World War II.

During the twenties and thirties, Germany paid increasing attention to the development of synthetic liquid fuels. This work resulted in the development of two main methods of attack, the hydrogenation of coal (Bergius process) and the utilization of carbon monoxide and hydrogen in the Fischer-Tropsch process. The capacity for synthetic fuels at the outbreak of the war was by no means adequate.

Since hydrogen was already produced in large quantities at ammonia plants, and compressors and other equipment were available at these plants, synthetic fuels started to compete with the fixed nitrogen industry both for its equipment and for its supply of hydrogen, particularly at Leuna and to some extent in the Ruhr. Leuna hydrogenated brown-coal tar to fuels. The tar was obtained by coking of brown coal to produce coke for hydrogen and carbon monoxide.

Leuna also produced methanol, isobutyl and higher alcohols. The isobutyl alcohol was converted into iso-octane for aviation fuels and the higher alcohols were hydrogenated to produce valuable fractions for other fuels. Total capacity for liquid fuels at Leuna was said to be 600,000 tons per yr. As a result, enough hydro-

(*Continued on page 188*)

Synthetic ammonia works of I. G. at Oppau as photographed by U. S. Air Forces April 9. This plant is producing fertilizers for the Allies

ZE'EV HALPERIN *Chief Chemist, Petri Wine Co., Escalon, Calif.*

TARTRATES
Recovered from Winery Wastes

Within the past four years, this country has strengthened its wartime chemical position by developing domestic sources of raw materials for tartrate chemicals. The development has centered largely around the California wineries, where crude tartrate materials are now being recovered in substantial quantities. This article, one of the first of a technical nature to be published on processes and techniques now in use in the industry, is based upon practical, operating experience in one of the larger recovery plants.—*Editors*

Prior to Pearl Harbor, this country was for practical purposes entirely dependent upon foreign sources for its supply of tartrate raw materials. These were largely imported in the form of wine lees, argols and some calcium tartrate from Argentina and the wine-producing countries of the Mediterranean basin. Although experimental work has been done on developing fermentation or synthetic processes for producing tartaric acid, the world's supply of tartrate chemicals is still derived solely from byproducts of the grape processing industry.

This country's entry into the war cut off the source of a large percentage of our tartrate raw materials just when the demand for tartaric acid and tartrate chemicals was rapidly increasing. However, at that time a number of domestic wineries initiated tartrate recovery programs in order to supplement the insufficient supply of imports from Argentina and other countries. Probably over 95 percent of all tartrates recovered in the United States now comes from California wineries, the remainder being recovered from wineries in the Finger Lakes district of New York. The present estimated recovery of tartrates from California wineries is 1,100-1,200 tons of semi-processed materials yearly. About half of this tonnage represents argols, cream of tartar and wine lees while the remainder is in the form of calcium tartrate averaging close to 95 percent purity.

This article, based upon practical experience in the field, outlines some of the current processes now in industrial use. It is hoped that the data contained herein will stimulate other wineries to a closer study of the technical feasibility and economic attractiveness of recovering tartrates for the American chemical industry.

Just what are tartrates? The term is rather vague, but in winery circles it includes all materials containing tartaric acid or its metal salts. The most common tartrates encountered in wineries are potassium bitartrate, known as cream of tartar, and calcium tartrate. These crude tartrates are the raw materials for the production of commercial tartaric acid, cream of tartar, Rochelle salts, tartar emetic and other tartrate chemicals.

Tartrates occur in the juice of grapes as well as in the skins and stems. When the grapes are crushed, most of the tartrates are carried into the juices and eventually find their way into the winery wastes.

SOURCES OF TARTRATES

Processing of grapes into wine gives rise to several different types of waste materials. The method of tartrate recovery is therefore somewhat different for each waste although the end products are the same. Winery tartrate-containing wastes are: (1) wine lees, (2) distilling materials still slop, (3) grape pomace and (4) wine stones.

When new wine is placed in storage a great deal of insoluble matter, including yeast cells, pulp and tartrates, settles out. These sediments constitute wine lees. Three types of lees are normally encountered in wine production, namely table wine lees, dessert wine lees and refrigeration lees.

Table Wine Lees—Table wines may be either red or white; the lees produced will vary in tartrate content depending on the method used in making each type of wine. In the case of red table wines, the fermentation is allowed to take place in the presence of the grape pomace (skins and seeds). When fermentation is complete, the wine is drawn off and placed in storage tanks. There the lees settle out. In producing a white table wine, the grape juice is drawn off the pomac before fermentation.

Since red wine grapes usually contain a higher concentration of tartrates than white wine grapes, the lees from red wines will be somewhat richer in tartrates than those from white wines. The average concentration of tartrates in table wine lees, red or white, is 0.1-0.3 lb. of potassium bitartrate per gallon with a slight "plus" for the red lees.

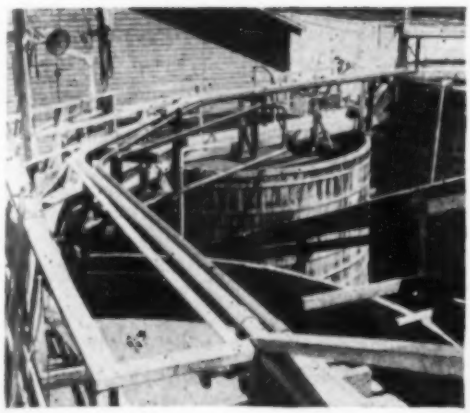
Dessert Wine Lees—In producing dessert wines, the general practice is to allow the juice to ferment only partially. At that point in the fermentation when the desired sugar concentration is reached, the juice is pumped into a fortifying tank where brandy is added to arrest fermentation by inhibiting the active yeast cells. At the same time, the alcoholic content of the wine is thereby increased to 21 percent. The dessert wine thus produced is pumped into storage tanks where the lees settle out.

Dessert wine lees are generally higher in tartrates than table wine lees since cream of tartar is less soluble in the higher concentration of alcohol (Table I). Dessert wine lees contain 0.2-1.0 lb. of cream of tartar per gallon; the alcoholic content will vary from 10-17 percent.

Refrigeration Lees—In order to render wines stable and clear, they are cooled to as low as 16 deg. F. As Table II shows, cream of tartar is only slightly soluble at this temperature. Hence some of the cream of tartar will crystallize out and settle to the bottom of the tank. Since

Table I—Solubility of Cream of Tartar in Aqueous Alcohol

Percent Alcohol By Weight	G. of $KHC_4H_4O_6$ per 100 g. of Sat. Solution
0	0.649
10	0.358
20	0.210
40	0.087
60	0.043
80	0.023
100	0.010



Above—Tartrate recovery plant showing still slop settling and clarifying tanks

Right—Chemically treated still slop being agitated with air before settling

the wine has previously been freed from most of its solid impurities, refrigeration lees are generally cleaner and richer in tartrates than either table or dessert lees. The cream of tartar concentration will vary from 1-3 or more lb. per gal. and the alcoholic content will be from 12-17 percent.

Grape Pomace—Pomace consists of the grape skins, short stems, seeds and pulp left in the fermenter after the removal of the wine or grape juice. The concentration of tartrates in grape pomace depends upon the initial concentration in the grapes and the method used in making the wine. The tartrate (as potassium bitartrate) content of grape pomace will vary from 1-5 percent.

Brandy Still Slop—This term includes all de-alcholized winery materials from the distillation of brandy produced either for fortification purposes or for sale as such. Distilling material, as it is called in the trade, may consist of material from the re-fermentation of sweet wine pomace or from wines produced exclusively for distillation purposes, pomace water washes, and pomace press wines.

These materials are de-alcoholized by distillation; the slop from the still is used for the recovery of tartrates. The concentration of cream of tartar in still slop varies from 0.02-0.07 lb. per gal., depending again upon the initial tartrate content of the grapes and the wine-making method employed.

Wine Stones—After newly made wine is racked into storage tanks, some cream of tartar will crystallize out and deposit on the inside walls and floor of the tanks. The deposits thus formed are known as "wine stones" and consist of 70-90 percent cream of tartar. As compared to other sources of tartrates, these stones play a very minor role.

From Table Wine Lees—First step in the recovery of tartrates from table wine lees is distillation. This serves two purposes; (1) To strip the lees of their alcohol and (2) to make the slop workable for the recovery of tartrates in the form of calcium tartrate. During distillation all crystalline cream of tartar will go into solution and thus will later be precipitated as the calcium salt. Solution is aided by the dilution from condensed steam.

RECOVERY OF TARTRATES

Lees slop is pumped from the discharge point of the still into wooden settling tanks. It is good practice to have settling tank capacity to handle double the amount of distillery slop produced daily. For example, a winery producing 50,000 gal. of distillery slop per day should have 100,000 gal. capacity in settling tanks. Slop is allowed to settle for 12-18 hr. The supernatant liquor, then fairly free of solid matter, is drawn off into an open, wooden precipitating tank. The size of this should be approximately equal to the daily output of distillery slop.

Chemicals used in the precipitation are $CaCl_2$ and hydrated lime. In general practice, it is best to add 0.5 lb. of commercial $CaCl_2$ in solution for each pound of cream of tartar to be precipitated. This is slightly higher than the theoretical requirement, but it takes into consideration the purity of the commercial $CaCl_2$ (about 75 percent) and allows a 10 percent excess of chloride. It is important that the addition of $CaCl_2$ solution takes place during thorough agitation. After addition of the chloride, a slurry of hydrated lime is added. This is produced by mixing 150 lb. of hydrated lime with 50 gal. of water.

Practical experience has shown that lime should be added to a definite pH value, which varies from 4.6-5.6 depending upon the cleanliness of the material and the concentration of cream of tartar. It is very important that the lime slurry be added slowly and well dispersed by agitation so that lime will not settle to the bottom of the tank and its neutralizing action thereby be limited. Some time must be allowed to elapse before determining the pH of the material after addition of lime. This is especially important as the end point is approached. The best procedure is to agitate the slurry, usually by air, for 5-10 min. before determining the pH.

Control of pH is a factor that greatly affects the purity of the final product. It may mean the difference between a calcium tartrate which is extremely soft, subject to microbiological spoilage and of low purity, and a material of sandy texture, easily workable, clean and of high tartaric acid concentration.

If the cream of tartar concentration in the slop is over 0.1 lb. per gal., much of it will crystallize if the temperature of the liquid falls below 90 deg. F. Thus it will be unable to enter into the reaction by which calcium tartrate is produced. Furthermore, these crystals of potassium bitartrate will be carried down with the calcium tartrate to cause a great deal of trouble later in the production of commercial tartaric acid.

After the desired pH has been reached, the slurry is agitated by means of air for 15-30 min. to assure over-all distribution of the precipitants. The calcium tartrate is then allowed to settle for 6-12 hr. If the medium is clean and the initial cream of tartar concentration close to 0.1 lb. per gal., most of the tartrate will settle within 2-3 hr. If the liquid is not brilliantly clear the settling time will be considerably longer, as suspended matter will prevent the calcium tartrate crystals from settling immediately. Good practice is to allow 6 hr. for settling. The supernatant liquor is then drawn off and the precipitated tartrate washed out of the tank with water into a shallow, open wash box.

During the process of precipitation, soluble KCl is formed. Since the calcium tartrate must be free of soluble chlorides, it should be given two or three changes of water in the wash box. When completely washed, it is dried to below 5 percent moisture; this assures high purity and avoids microbiological spoilage which would otherwise take place. Drying is best accomplished by the use of a dryer

Table II—Solubility of Calcium Tartrate* and Cream of Tartar in Aqueous Solutions

Deg. F.	G. of Calcium Tartrate per 100 cc.	G. of $KHC_4H_4O_6$ per 100 cc.
32	0.0365	0.30
50	0.0401	0.32
68	0.0475	0.40
86	0.0631	0.53
104	0.0875	1.30
122	0.1100	1.80
140	0.1262	2.40
158	0.1430	3.30
176	0.1798	4.40
185	0.2190	
212		6.50

* Cantoni & Zachoder, *Bull. Soc. Chem.* 37, 33; 747 (1905).

consisting of a steam-jacketed stationary shell and a rotating shaft equipped with mixing paddles. During drying the calcium tartrate is rendered a fine powder which is ready to be sacked and shipped to the tartrate chemicals plant.

In order to recover tartrates from the mud remaining in the settling tanks, it is necessary to leach this with hot water until the bitartrate content of the wash is below 0.02 lb. per gal. This wash water is added to fresh clarified slop; calcium tartrate is precipitated as already outlined.

After the last wash is decanted off, only a very heavy and paste-like material remains in the tank. This represents mostly pectins, proteins, pulp, various organic acids such as malic and acetic, yeast cells and other solids. In present practice, this leached mud is discarded.

From Dessert Wine Lees—Dessert wine lees are richer in cream of tartar than table wine lees. In order to avoid recrystallization of cream of tartar after distillation, water should be added to dessert lees prior to distillation. The same procedure is then followed as for table wine lees, the only difference being in the number of hot water washes. Three washes are usually given; at times, if the concentration of the settled mud is still high, a fourth wash may be advisable.

If it is desired to produce a certain amount of crude cream of tartar as such from sweet wine lees, the freshly clarified slop (first run liquor) should be drawn off and cooled gradually to permit crystallization of potassium bitartrate. The crystals are then collected, dried and shipped as crude argols. Mother liquor and washes are used in the production of calcium tartrate.

From Refrigeration Lees—The amount of refrigeration lees in a winery is usually quite small. Since these are very rich in cream of tartar, they are simply washed, dried, and shipped as crude argols. The wash water, which will contain considerable tartrates and some alcohol, will be added to either table or dessert lees for the usual processing. Thus both tartrates and alcohol will be recovered.

From Wine Stones—When crystallization of cream of tartar has produced a considerable coating of this material on the inside surfaces of the wine tanks, manual chipping is used to collect the tartrates and clean the tanks. An extraction process is used by some wineries; either a hot water, acid or alkaline extraction method is used and the tartrates are recovered as calcium tartrates. When chipping is resorted to (as is the usual case) the material is washed, dried and shipped as crude argols.

From Still Slop—Recovery of tartrates from distilling material still slop differs somewhat from that for lees. The concentration of cream of tartar in still slop averages only about 25 percent of that for table wine lees.

When the slop comes from the still, it is extremely cloudy in appearance. It is impossible to precipitate calcium tartrate from such a low-concentration, impure liquid and still produce a good quality product. It is necessary to clarify the material prior to chemical treatment in order to get good precipitation with a product of high purity and good workability.

CLARIFICATION

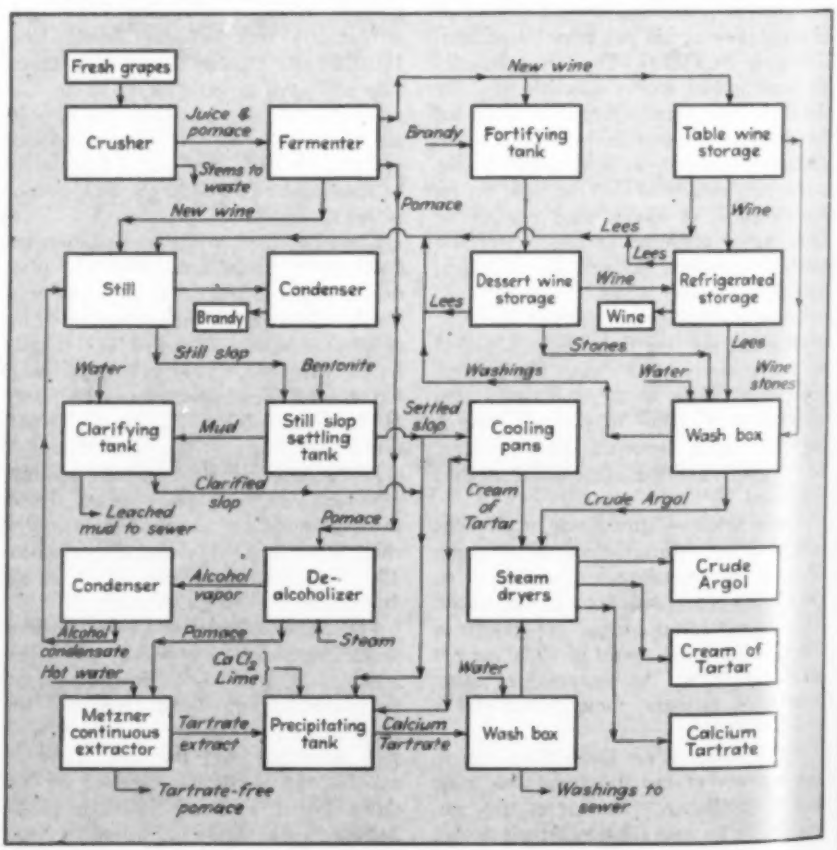
Clarification is accomplished by adding bentonite, slurried either in water or in the slop, at the rate of 5-10 lb. per 1,000 gal., depending on the condition of the material. Excessive bentonite will lower the recovery of clarified liquids, since the coagulated impurities will tend to stay in suspension instead of going to the bottom of the tank to form a solid pack. The slurry should be agitated thoroughly. Some operators prefer to add the bentonite prior to distillation. However, somewhat better results are obtained by clarification after distillation.

These hot distillery slops generally clarify very readily, so that a settling period of from 4-8 hr. is sufficient. If properly handled the slop will clarify up to 90 percent of its original volume. When clarification is complete, the clear liquid is pumped over to the precipitating tank where precipitation is carried out along the same line as for lees. However, special care should be taken toward the end point. A slight excess of lime will tend to bring the pH up to a point where non-tartrate matter will also precipitate, resulting in a poor product. In exceptionally clear media, the pH should not exceed 5.6 and even 4.5 is recommended by some operators. Best recovery can, however, be obtained at a pH of 5.0.

Since the concentration of cream of tartar is at times as low as 0.02 lb. per gal., the weight of calcium tartrate recovered in one precipitation is small and great care should be taken not to overshoot the optimum pH point. When this happens, washing and rewashing of the calcium tartrate will result in a considerable loss, since many of the crystals will stay suspended in solution by precipitated pectins and proteins.

From Grape Pomace—Successful recovery of both tartrates and alcohol from grape pomace has been accomplished within the last three years by a continuous method developed by Dr. E. Kurt Metzner of Los Angeles, who has been to a large extent responsible for the sound tartrate recovery programs of leading wineries in California. In this process, which will be described in detail in a future issue of *Chem. & Met.*, the pomace from the fermenting room is passed through a steaming operation, during which the alcohol is evaporated. The alcoholic vapors are condensed and the alcohol recovered. After this de-alcoholizing and steaming process the pomace is discharged into the tartrate extractor.

General flowsheet showing the recovery of tartrates from winery wastes



Calcium tartrate slurry being run from the precipitating tank into the wash box; here the green crystaline tartrate is still subject to microbiological spoilage

From there it is conveyed through a washing battery and rendered free of adhering tartrate solution by counterflow of hot water from the alcohol condenser. At the end of the washing battery, the pomace goes through a continuous pressing operation to remove excess water. From there it is discharged to the pomace pile.

At a given point in the extractor, the dilute tartrate solution is continuously withdrawn and pumped to the recovery plant where the tartrates are recovered much in the same manner as described for distilling material still slop. The entire operation is continuous and is cut in with the pomace conveying system of the winery.

PRINCIPLES OF PRECIPITATION

Successful production of calcium tartrate from winery wastes depends upon supplying the proper amount of calcium and attaining the correct pH by means of neutralizing the bitartrate with an alkali. The reaction that takes place when $CaCl_2$ and CaO are added to a solution of potassium acid tartrate can be presented as follows:

$$2(KHC_4H_4O_6)+CaCl_2+CaO+8H_2O= 2(CaC_4H_4O_6.4H_2O)+2\,KCl+H_2O$$

For a solution of pure potassium bitartrate in water, this reaction will take place at a pH of about 6.8-7.2. However, in practice the pH should not satisfy these conditions. Winery wastes are very complex organic systems containing besides cream of tartar, many soluble organic and inorganic salts, organic acids, as well as proteins and pectins. All these have a tendency to affect the reaction by which calcium tartrate is formed. The isoelectric point of some of these substances is close to the neutral point, so that when the latter is approached they will precipitate. The result is a product of poor quality.

Through plant practice it has been found that the pH values of 4.5-5.6 will usually cover most of the conditions encountered. The lack of this knowledge was largely responsible for the poor results obtained by many operators four years ago when the tartrate recovery program in California first really got under way.

At a pH higher than 5.6 many other materials will precipitate with calcium tartrate. When this precipitated material has settled, the product will have a mushy consistency; it is then very difficult to wash the tartrate free of impurities and much of it will be lost in the washing operation. The material will also be subject to the attack of several anerobic thermophilic and mesophilic bacteria. These attack calcium tartrate, and if care is not taken they may destroy the entire batch within a short time. They may also infect the precipitating tank and thus widen the scope of their destructive work.

If the liquid is high in cream of tartar (about 0.1 lb. per gal.) as in the case of the first run of table or dessert lees slop, and if it is not very clean and clear, care should be taken to stay close to or under a pH of 4.8. If the same liquid is absolutely brilliant, a higher pH may be the goal. It is the experience of some operators that recovery of calcium tartrate is greater at a higher pH, providing the physical condition of the material allows use of a higher pH (5.3-5.6). Should the lees material be lower than 0.1 lb. per gal. and cloudy rather than clear, the pH should not go over 4.2-4.4.

In precipitating calcium tartrate from distilling material slop where the average concentration is only 0.03 lb. of cream of tartar per gal., the determining factor in arriving at the optimum pH is again the cleanliness of the material. Since distilling material slop is clarified prior to precipitation, a higher pH can be reached. The recovery will thus be high and the product will be of good quality. Some operators prefer to precipitate calcium tartrate from non-clarified distilling material prior to distillation. In this case the pH should be well under 4.4 or the product will be of extremely poor quality and stability.

From the chemical equation it can be seen that the requirements of treating chemicals are equivalent to about 0.3 lb. of $CaCl_2$ and 0.2 lb. of CaO per lb. of cream of tartar. From actual experience it has been found that an excess of $CaCl_2$ is desirable, the usual amount added being 0.5 lb. per lb. of cream of tartar. Since lime is added to a certain pH, it is not determined by weight as is the chloride.

Space cannot be given to a complete consideration of the economic values to a winery of tartrate recovery from each of its sources. However, an examination of recovery from distilling material still slop may prove valuable since this process has come into its own only within the last three years.

In general, a winery with a daily distilling output of 100,000 gal. should realize enough profit from the tartrates produced in one grape season (8-14 wk.) from still slop to defray a considerable part of the expense of building and equipping the tartrate extraction plant.

ECONOMIC OBSERVATIONS

What recovery can be expected from this daily 100,000 gal. of distilling material slop? With an average of 0.03 lb. of cream of tartar per gal. of slop, there should be present a total of 3,000 lb. of cream of tartar. If this theorectical amount is converted into calcium tartrate, the weight of the latter recovered should be 4,140 lb. of its maximum purity of 57.6 percent tartaric acid. However, such is not the case. The solubility of calcium tartrate (Table II) enters into the picture. Approximately 0.01 lb. of calcium tartrate will be soluble in each gallon of the treated slop at the temperature of operations; this soluble portion cannot be recovered. Therefore, only $\frac{3}{5}$ of 4,140 or 2,670 lb. will actually be produced per day. Considering the average purity of 54.5 percent tartaric acid and present market prices, this daily production will be valued at close to $700. For a grape season, the value of byproduct tartrates recovered may range from $35,000 to over $65,000 depending upon the length of the season and amount of grapes crushed.

Since no charges can be made against the raw material, which is otherwise a total loss, the profits realized by the winery are determined solely by the difference between receipts for the material produced and expenses involved in production; these, of course, include labor, chemicals, steam and power, and overhead. Such expenses are to a great extent determined by the efficiency of the plant and management set-up. Two operators are usually able to take care of all processing and handling operations.

Calcium tartrate is dried to less than 5 percent moisture

FROM THE VIEWPOINT OF THE EDITORS—

S. D. KIRKPATRICK, Editor • JAMES A. LEE, Managing Editor • THEODORE R. OLIVE, J. R. CALLAHAM, Associate Editors • HENRY M. BATTERS, Market Editor
L. B. POPE, RICHARD W. PORTER, JACK V. HIGHTOWER, EDMOND C. FETTER, Assistant Editors. • R. S. McBRIDE, Consulting Editor

FOUR-WAY BENEFITS OF RESEARCH

RESEARCH to accomplish large results for the public has come to be an organized business. This fact has long been known by most *Chem. & Met.* readers, but now the public can appreciate it because it has seen the tremendous military benefit from the large organization which produced the atomic bomb.

Two lines of argument will proceed from these facts. One resulting conclusion is right. The other is wrong. It is important that engineers and scientists guide official thinking and inform the public so that there may be general acceptance of the right, and repudiation of the wrong.

Wrong reasoning on this subject is so easy, because there is a considerable element of truth in the assumptions made. Here is the way many are likely to go astray: Organized research produces big results. Big results are important to the public. (True thus far.) Hence the public must control all steps and all use of the results. (And that is where the error begins.)

The right reasoning starts the same way. Big results require big effort. There must be public encouragement of big effort. The public interest must be uppermost but the public does *not* need intimately to control every step in the research program. (Here is where the two systems of reasoning separate.)

Most technical men know in detail the arguments which underlie this proper interpretation of organized research. We know that big achievements, like a synthetic rubber industry or the atomic bomb project, require big spending which cannot come from a single company or even from an entire industry. If we are now to apply the same research methods to equally important problems of the peace, such as providing millions of new jobs in an expanding economy, there may be need for larger expenditures than private funds could supply. We must explain this to the public who might otherwise accuse us of purely selfish motives.

And we must also show the public that it is but one of the four groups which properly can expect benefit from successful research. The investor who makes the research possible is entitled to some reward. The enlarged and improved industry must provide more payroll for the workers as the results of research are applied in business. Management, including research workers, must be rewarded more generously because they have contributed the creative thinking. And then the public as customer and user must get its share through lower costs, improved products, or entirely new services or commodities. When the four parties share in the benefits everyone gains.

In a sense it is the job of the government to see to it that no one party interested in research and development gets too big a share of the benefits. But that does not mean that we need to have every bit of research under government supervision, nor even that the results of research should be managed by public officials. The social and economic factors which divide benefits among workers, managers, investors, and customers will function best if the government merely looks on as an umpire. It need not become a player. If it does the results are likely to be harmful, not helpful.

As Washington and the public appraise the atomic bomb problem let us all see whether as professional men we can not guide the thinking along these sound lines. Then the benefits of organized research will be rightly shared. And the stimulus for more and more research will continue.

WELCOME NEWS

EXECUTIVE order 9568 signed by President Truman on August 25 provides a sorely needed mechanism for the release and dissemination of the scientific and technological information obtained by military and civilian investigators from enemy plants and laboratories. Authority under this order was immediately delegated by the Director of War Mobilization and Reconversion to the Secretary of Commerce. A new Publication Board with J. C. Green as its executive secretary has been set up in that department.

Meanwhile the Enemy Technical Reports Committee, which is comprised of WPB technical representatives under the chairmanship of Dr. Donald B. Keyes, will integrate its future operations into those of the Publication Board so that a single uniform policy will now control the release of technical and industrial information of non-military character. Thus after several months of debate and negotiation, the way has finally been cleared for all to share in the results of the investigations of TIIC, the Chemical Warfare Service and other groups that have been studying the German chemical industry since long before V-E Day. Summaries of some of the first technical reports to be officially released will be found in this month's *Chem. & Met.* Others will follow in subsequent issues.

TECHNOLOGISTS NEEDED!

SCARCITY of competent, well-trained personnel in chemical engineering and related scientific or technical fields remains alarming. Much of the job of reconversion is slowed by inability to get enough professional workers to do the job promptly.

This is serious for everyone. Remedies must be sought for the immediate future and for the long pull also. Industry executives as well as chemical engineers can exert their influence helpfully in two ways.

For immediate relief we should continue our demand

that scientific and engineering personnel be promptly released from the Army and that no more persons of that sort be drafted. Harry L. Derby, president of the Manufacturing Chemists' Association has taken vigorous steps in the hope that the nation's leading chemical employers can persuade Army and Selective Service officials to act properly. Further demands directed to the Army and through intelligent Congressmen or Senators are needed.

For the long pull we must have more support for the training of engineering and scientific students. Plans have been made by the War Manpower Commission to enroll 12,000 students this Fall in medical, dental, premedical, and pre-dental college courses. Comparable effort is even more needed in the fields of physics, chemistry, and chemical engineering. We must have prompt renewal of the flow of trained brain power into industry and institutional science.

There is no single "best way" in which to support either the immediate or the long-time needs which we recognize. But every professional man and every business executive should utilize all appropriate occasions for making clear to the public generally, as well as to public officials, the need for both prompt and long-time action. Too few understand the importance to the public of these matters. Those who are informed must become educators so that the needs will be met.

THE COST OF MONEY

AMERICAN enterprise is built, maintained and modernized with cheap money. Interest rates are very low as compared with the historic averages. Thus the direct cost of money is easily appraised. But there is one element of indirect cost commonly forgotten.

One of the means by which cheap money is maintained is the influence of the government to keep low the interest rate on the public debt. For political reasons this is essential. And the government does this in part by offering to lend money even to private borrowers at low rates of interest if the money cannot be had from normal commercial sources.

The indirect effect is a double burden on business which does not show in the interest payments. Part of this burden is greater taxes caused by deficit financing. But more subtle, and perhaps more serious, is the fact that by lending money to industry the government gets a constantly increasing control over business. Those who welcome cheap money for chemical enterprise can well consider these indirect factors of cost which are not involved in doing business with private funds.

INDUSTRY-UNIVERSITY PAYOFF

PUT yourself in the position of the veteran who went into the Army directly after completing his undergraduate course in engineering. He would like to go back to college for some graduate work and a little freshening up on forgotten subjects. But he's also attracted somewhat by the idea of a job with a good company, especially if he could earn enough to carry out certain personal plans that had been postponed by overseas service. It would be fine, he thinks, if some enterprising employer would provide the chance for combining a beginner's job with the opportunity for bona fide graduate study in some recognized educational institution.

That is exactly the arrangement that the Allis-Chalmers company has worked out with the Illinois Institute of Technology. From now on it plans to train its young engineers in a program combining practical experience in shop or office work with academic study in graduate courses leading to advanced engineering degrees. The company is not entirely unselfish in providing this program. Their executives realize that graduates often have little basis for selecting the job for which they are best fitted, and that there might be a considerable saving all around if this two-year training course resulted in better utilization of the individual's aptitudes and abilities. If fitted into the job for which he is best suited, his interest and enthusiasm should help him get ahead, bring forth his best achievements. That should pay off for both the man and the company. And, in this process, higher education gets another and very practical boost from industry.

LEND-LEASE STOPS

NO WELL-INFORMED person will question the necessity for prompt termination of lend-lease arrangements. The law required this. The fuss about the termination has much more to do with the manner in which it was executed than with the fact itself.

Important to process industries is the significance of this in future international business. That is not too easy to estimate. But a few facts are clear. They become evident when one understands a single fact as to why the British Government was so hard hit. Britain had a budget based on the assumption of continuing war through this (American) fiscal year. The sudden stoppage of hostilities saves money and lives; but leaves the new Atlee government unprepared for self-financing and prompt supply of many civilian necessities which were expected through lend-lease channels.

The immediate consequence of this is a continuing necessity for American goods, but an increased difficulty in finding any means for financial settlements. The British people are too proud to beg. They must now go to work on a different assumption as they change from war jobs to peace activities. They must continue low consumption of goods at home in order to manufacture for export so that they may get credit to pay for needed food and other imported essentials for living. The consequence is an anticipated increase in competition from British industry in world markets.

INTEGRATION OF FACILITIES

THE TYPICAL chemical plant is often a hodgepodge of production facilities. As occasion has demanded, space has been found somehow in the existing buildings for the expansion of long established processes and for equipment to make additional products. This condition has resulted from an inability to plan far enough ahead.

What can be accomplished by logical long-range planning, when it is possible, is illustrated in the ethyl cellulose operations of the Hercules Powder Co. at Hopewell, Va. They are described elsewhere in this issue of *Chem. & Met.* In this plant the manufacture of ethyl cellulose is tied-in with the utilization of byproducts and production of the raw materials to an extent rarely encountered in chemical industry.

CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

$50 WAR BOND FOR A GOOD IDEA!

Until further notice the editors of *Chem. & Met.* will award a $50 Series E War Bond each month to the author of the best short article received during the *preceding* month and accepted for publication in the "*Chem. & Met. Plant Notebook.*" Articles will be judged during the month following receipt, and the award announced in the issue of that month. The judges will be the editors of *Chem. & Met.* Non-winning articles submitted for this contest may be published if acceptable, and if published will be paid for at space rates applying to this department. (Right is reserved, however, to make no award in months when no article received is of award status.)

Any reader of *Chem. & Met.*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are criteria of the judging.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address entries to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York 18, N.Y.

AUGUST WINNER!

A $50 Series E War Bond will be issued in the name of

FOSTER C. BENNETT
The Dow Chemical Co.
Midland, Mich.

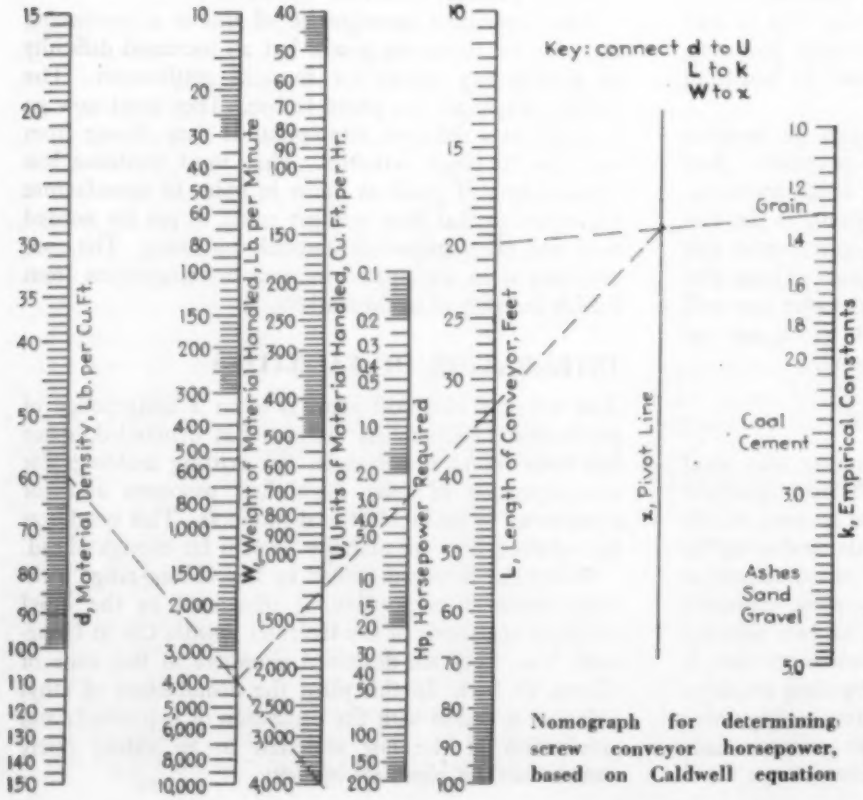
For an article dealing with a method of calibrating pumps by height of a vertical stream that has been judged the winner of our August contest.

This article will appear in our October issue. Watch for it!

July Contest Prize Winner

NOMOGRAPH BASED ON CALDWELL EQUATION GIVES CONVEYOR POWER NEEDS

IRA J. HOOKS and FRANK KERZE, JR.
Department of Chemical Engineering
New York University, New York



Nomograph for determining screw conveyor horsepower, based on Caldwell equation

THE accompanying nomograph, based on the Caldwell equation, gives a convenient means of calculating the power requirements of screw conveyors when handling a variety of materials under widely varying conditions. The results given by the nomograph are on the high side and if more accurate estimates are needed, they can be obtained from the more elaborate equations and data given in the manufacturers' catalogs.

The equation is as follows:

$$\text{Hp.} = \frac{k\,U\,d\,L}{1{,}980\,000} = \frac{k\,W\,L}{33{,}000}$$

The units of the equation are described on the nomograph. Use is indicated by the example shown where the density $d = 60$ lb. per cu. ft.; the volume handled $U = 4{,}000$ cu. ft. per hr.; the conveyor length $L = 20$ ft.; and the constant for the material $k = 1.3$. If the weight rate W is given in tons per hour, divide by 0.03 to obtain pounds per minute.

REFERENCES

Badger and McCabe, "Elements of Chemical Engineering," p. 627, McGraw-Hill Book Co., Inc., New York, 1936.

Perry, "Chemical Engineers' Handbook," p. 2234, McGraw-Hill Book Co., Inc., New York, 1941.

HOW TO DESIGN A SPIRAL RIBBON

A. B. PORTER
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Harrison, N. J.

IT IS often necessary to construct makeshift equipment for experimental use, or special set-ups made in one's own shop to care for cases where the design is uncertain, or outside construction is too slow or too expensive. A perplexing problem of this type is the design of spiral ribbons of the type commonly used in certain types of

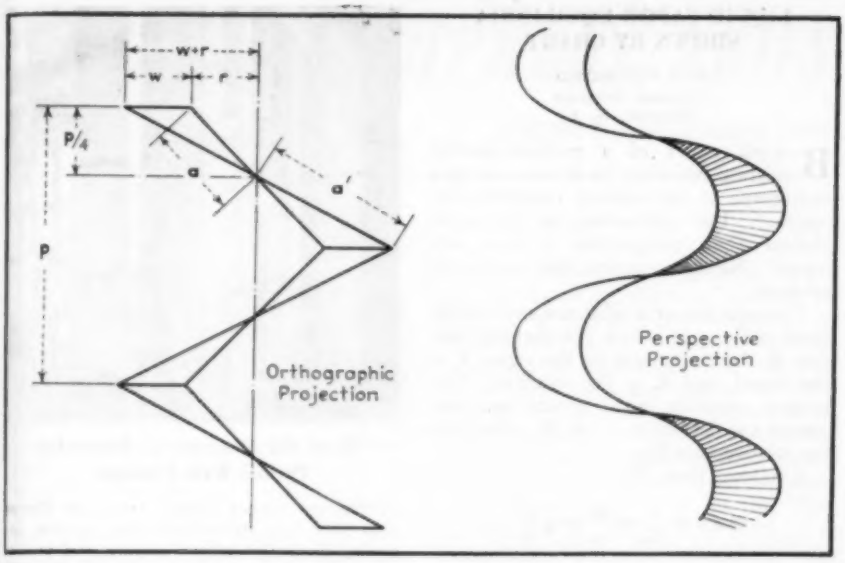

Fig. 1—Geometry of spiral ribbon design

Fig. 2—Ribbon shown in perspective

mixers. A simple algebraic solution is offered here, in as much as it is not readily available in handbooks.

Once a few dimensions are known a workable ribbon mixer can be fabricated from metal rings of the desired width which are cut radially and "pulled out" to form spiral sections that are then welded or riveted, end to end, to produce the complete spiral. The variables involved include p, the pitch of the spiral (distance of one turn along the axis); w, the width of the spiral; r, the inner radius of the spiral; R, the inner radius of the circle to be cut; a, the long axis of the small ellipse shown in Fig. 1; a', the long axis of the large ellipse; b, the short axis of the small ellipse; b', the short axis of the large ellipse; and N, the number of circles that must be cut per revolution of the spiral.

From the diagram in Fig. 1 it will be readily seen that

$$a = \sqrt{(p/4)^2 + r^2} \text{ and } a' = \sqrt{(p/4)^2 + (w + r)^2}$$

Furthermore, it will be seen that the b axis of the ellipse (only half of it is actually described by the spiral) in a plane normal to the drawing is the same as the radius of the spiral. Thus, $b = r$ and $b' = w + r$. Note now that the number of circles of radius R required to construct one complete revolution of the spiral can be expressed by the two equations:

$$N = \frac{\pi (a + b)k}{2\pi R} \text{ and } N = \frac{\pi(a' + b')\, k'}{2\pi\ (R + w)}$$

or

$$N = \frac{(a + r)k}{2R} = \frac{(a' + r + w)k'}{2(R + w)}$$

However, $k = 1 + \frac{1}{4}m^2 + 1/16m^4 +$ etc., and $m = (1 - b/a)/(1 + b/a)$. In order to effect a 1 percent increase in k, $\frac{1}{4}m^2 = 0.01$, $m = 0.2$ and the ratio $b/a = r/a = 0.667$. Values higher than this cause smaller error and those less will make the error larger. For the most practical range, $k =$ unity within 1 percent.

Therefore, when r/a is greater than 0.667, the following simple forms can be used to compute within 1 percent of accuracy the proper dimensions of the circles and the number of circles needed to fabricate the mixer:

$$R = \frac{w\ (a + r)}{a' - a + w} \text{ and } N = \frac{a + r}{2R}$$

When r/a is less and this same accuracy is desired, the more complex expression in the derivation may be used. Finally, after the circles are cut and opened to proper pitch, they are fitted on to the projecting arms on the mixer shaft.

SLOW RATE FLOW CONTROLLER OF STANDARD PARTS

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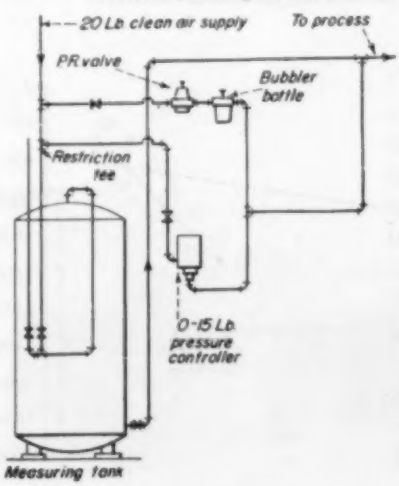
IN THE accompanying sketch a relatively inexpensive and sensitive flow controller is shown, suitable for applications where air is used to move liquids. Its application is restricted to and especially suited for processes where one ingredient must be introduced slowly and at a constant rate into another liquid.

Referring to the sketch, the operation of the controller is simple, and is as follows: The liquid is caused to flow from the measuring tank by the pressure of a small flow of air into the top of the tank. The flow rate is maintained constant by holding a constant pressure at some point in the liquid transfer piping that conveys the liquid from the tank to the process. In the sketch, this point is in the upper right corner of the drawing, where a connection is taken off to a seal. This pressure operates on the control instrument to maintain just the desired pressure of air in the measuring tank. Should the flow in the liquid outlet pipe increase, then the static pressure at the point indicated will increase and the controller will operate to reduce the tank pressure. Should the flow decrease, then the pressure in the liquid pipe will fall and the controller will operate to increase the air pressure in the tank.

Hook-up of flow controller for liquid moved by air pressure



In more detail, the result is achieved as follows: Air at some suitably reduced pressure is supplied to both the tank and the controlled air pressure regulator. In the first instance the air passes through a restriction tee on its way to the tank, part of it being bled off at the tee by means of a small flapper valve in the Brown P097A "one-pipe" controller. The amount of air that is bled determines the pressure in the tank. The setting of the flapper valve in the controller is accomplished by applying the liquid pressure in the outflow line to an air-seal system connected to the bellows of the controller. The seal consists of a small pressure reducing valve and a bubbler bottle and can be eliminated when the liquid is non-corrosive and can be permitted in direct contact with the bellows. It operates as follows: The air flow through the bubbler is adjusted for one or two air bubbles per second. This air must, of course, enter the liquid system. Its pressure balances the liquid pressure and keeps liquid from the bellows. Thus it will be seen that liquid pressure changes are communicated to the bellows to bring about control action and alter the air pressure in the feed tank.

This system is inherently more sensitive than one employing a diaphragm valve since there is no valve friction involved. To give an idea of the service for which the arrangement is suitable, it has been used to pump a liquid at 1.67 g.p.m. against a pressure of 3 lb. per sq.in. ga. Its air consumption is so low as to be negligible in a plant where liquids are moved by air.

GRAPHICAL SOLUTION OF MATERIAL BALANCES

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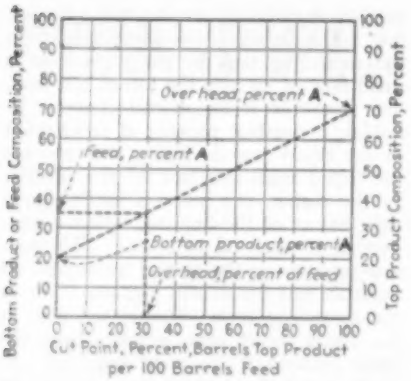
Torrance, Calif.

MODERN chemical industry is developing around essentially pure compounds. Consequently, precision separations by fractionation, extraction, or absorption are commonplace. As a result the plant operator is burdened with calculations pertaining to the split or distribution of the important components of the feed between two product streams. The alignment chart given here has been developed to supply a simple and quick method of calculation of


Overhead, percent A
Feed, percent A
Bottom product, percent A
Overhead, percent of feed
Bottom Product or Feed Composition, Percent
Top Product Composition, Percent
Cut Point, Percent, Barrels Top Product per 100 Barrels Feed

Alignment chart for determining distribution of feed material between two product streams

material distribution between two streams.

The chart solves the typical material balance equation, $x_f F = x_b B + x_d D$, for any single unknown. The nomenclature used is the usual distillation terminology in which F, B and D refer to the quantity of feed, bottom product, and distillate or top product and x refers to the concentration of a particular component in the stream to which the subscript refers.

For example; consider 100 volume units of feed containing 35 liquid volume percent of component A, splitting into two streams. The top and bottom streams contain respectively 70 and 20 liquid volume percent of component A. Then $100 \times 35 = 20(100 - D) + 10D$ or $50D = 100(35 - 20)$ and $D = 30$; i.e., 30 percent of the feed is taken overhead. The same example is solved on the chart.

The chart can be drawn to any size, depending upon the accuracy required. Its use is faster and presents much less chance of error than slide-rule calculations. The method of calculation can conveniently be presented on the chart and thus reduces the chance of personal error which might arise from attempting to solve an equation. The chart can be used with equal rapidity to solve for any one of the four unknowns and is not limited to binary separations. The distribution of any number of components can be determined provided that the entering stream is divided into only two streams.

LIQUID-VAPOR EQUILIBRIA SHOWN BY CHART

MELVIN NORD
Chemical Engineer
Matawan, N. J.

BOILING POINT of a multicomponent mixture can easily be determined on a nomograph if the relative volatilities are constant. The calculation of the equilibrium vapor composition is then very simple. Neither requires trial and error solution.

The volatility of a substance may be defined as $K = y/x$, where y is the mol fraction of the component in the vapor, x in the liquid, and K is the volatility. The relative volatility with respect to component n is defined as $= K/K_n$, where α is the relative volatility.

It follows, then, that

$$\Sigma \alpha x = \frac{1}{K_n} = \frac{x_n}{y_n} = \alpha \frac{x}{y}$$

Therefore,

$$y = \frac{\alpha x}{\Sigma \alpha x}$$

This equation determines the vapor composition. The summation of αx can be plotted as an ordinary parallel line nomograph, with axes for each component and with suitable reference lines.

Since the temperature and pressure determine the values of α (and hence of αx and $\Sigma \alpha x$ for a given mixture), we can plot a line coordinate chart with $\Sigma \alpha x$ and π as vertical axes and T plotted in between from experimental data. (Here π is the total pressure, and T is the temperature).

We then have a nomograph for determinating the boiling point of any mixture of the components. In addition, it will be very simple to run off $v = \alpha x/\Sigma \alpha x$ on the slide rule for each component, thus determining the equilibrium vapor composition.

In the special case of three components, an especially simple nomograph can be made. We have $\Sigma \alpha x = \alpha_1 x_1 + x_2 + \alpha_3 x_3$, using component (2) as the reference component. This can be written as $\Sigma \alpha x - \alpha_3 x_3 = \alpha_1 x_1 + x_2$.

If we plot αx_1 and x_2 as an addition type nomograph with horizontal axes, and $\Sigma \alpha x$ and $\alpha_3 x_3$ as a subtraction nomograph (i.e., $\alpha_3 x_3$ reversed) with vertical axes, the lines connecting $\Sigma \alpha x$ with $\alpha_3 x_3$, and $\alpha_1 x_1$ with x_2 will intersect in a series of points, the locus of which is the pivot line. In this case, the pivot line is curved. The main advantage of this type of nomograph is its compactness.

Such a nomograph for the system benzene- toluene- xylene appears in the accompanying diagram. In this case, since Raoult's and Dalton's laws are followed, $y = Px$ and $\pi = P_T \Sigma \alpha x$, where P_T is the vapor pressure of toluene, the reference component. Therefore

$$P_T = \frac{\pi}{\Sigma \alpha x} = f(T),$$

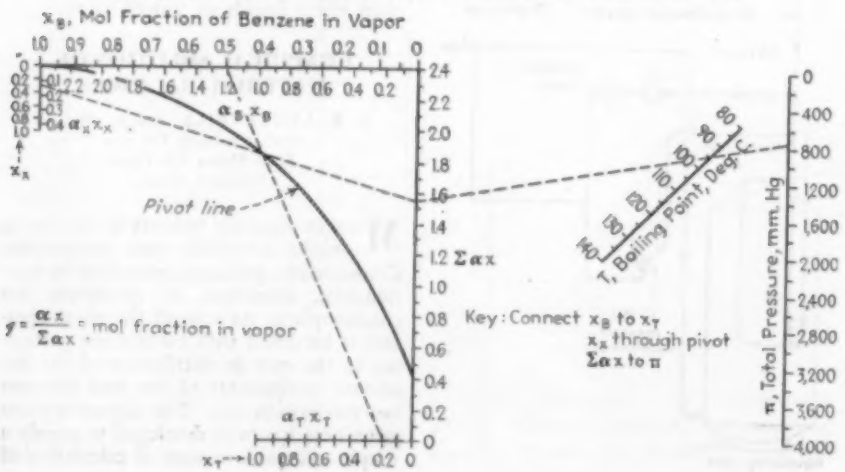
and so the temperature scale falls along a diagonal connecting the zeros on the $\Sigma \alpha x$ and π (reversed) scales.

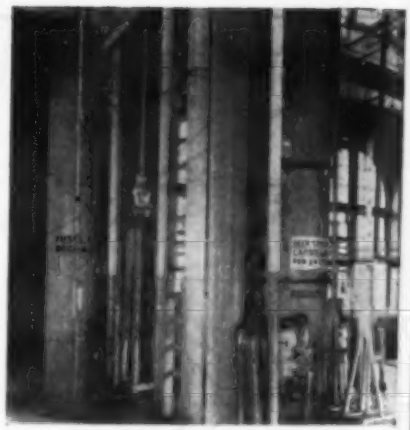
For benzene, we have used $\alpha_1 = 2.40$, and for xylene, $\alpha_3 = 0.42$. These values are fairly constant. (See Robinson and Gilliland, "Elements of Fractional Distillation," 3d Ed., p. 155).

The accompanying nomograph indicates that for $x_B = 0.50$, $x_T = 0.20$, and $x_X = 0.30$, the boiling point at 760 mm. is approximately 94 deg. C. The vapor compositions may now be calculated from the equation $y = \alpha x/\Sigma \alpha x$. For rough work, the value of αx and $\Sigma \alpha x$ found on the nomograph may be used. If greater accuracy is desired, the proper values of α for each component may be determined, since the temperature and pressure are known.

Thus, the nomograph determines the boiling point with sufficient accuracy for vapor-liquid calculations, regardless of whether or not the relative volatilities are assumed constant.

Nomograph for boiling points of benzene-xylene-toluene mixtures





Fusel Oil Decanter in Kentucky Packed With Fiberglas

Several new process industry uses for fibrous glass have been reported in recent months, including distillation column packing, and protection of catalysts from contamination. Still another use described by Owens-Corning Fiberglas Corp., is a glass-packed fusel oil decanter 15 ft. high and 22 in. in diameter that is now handling the distillate from about 2,000 bu. of grain daily at General Distillers Corp., Louisville, Ky. W. H. Stone, production superintendent, describing the decanter as a radical innovation states that the use of the randon-oriented glass fiber packs has saved construction materials, stepped up fusel oil production and eliminated the labor formerly needed for subsequent fusel oil purification. The superior performance is attributed to the large surface area of the packing, approximately 196 sq.ft. per cu. ft.

PROCESS EQUIPMENT NEWS

THEODORE R. OLIVE, Associate Editor

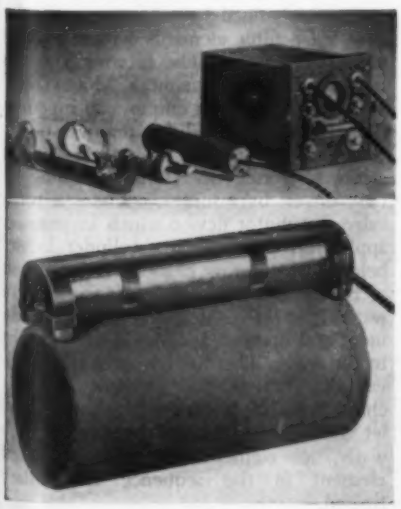
GAMMA RAY GAGE

AT RECENT demonstrations in several cities, the Penetron, developed by the Texas Co., and now manufactured commercially by Engineering Laboratories, Inc., Tulsa 3, Okla., was given its first public showing. The Penetron, which employs a source and a detector of gamma rays, is being used in the measurement of metal thickness, for the detection of liquid level in inclosed equipment, and in the measurement of liquid density.

The instrument was initially developed by D. C. G. Hare, a physicist in the employ of the Texas Co. at the Port Arthur plant. It was later improved by Dr. Gerhard Herzog, a physicist formerly engaged in cosmic ray measurements at the University of Chicago. As now improved, the instrument weighs but 35 lb. and is readily portable.

Previously, the usual methods available for measuring the thickness of metal walls were either to drill a hole which later had to be plugged, or to measure inside and outside diameters. The new method, which is extremely simple, employs gamma rays given off by a needle containing 1 mg. of radium in the form of a commercially available salt. The source is surrounded with a shield containing a window which directs the beam of gamma rays in the desired direction. The gamma rays emerging from the source are allowed to impinge on the wall to be measured. A portion of the rays passes through the wall and emerges on the opposite side, serving no useful purpose. Another portion of the radiation is scattered in all directions, and some of the scattered rays emerge on the same side of the wall from which they originally entered.

Penetron gamma ray thickness meter showing below magnetic head

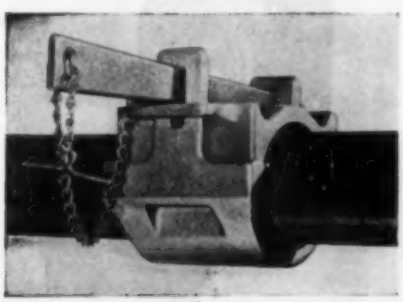


This "back-scattered" radiation is utilized in measuring the wall thickness. A detector is provided for measuring this latter radiation, which can be expressed in terms of the thickness of the wall, since for a wall of given composition the intensity of the back-scattered radiation increases as a direct function of the wall thickness. In order that this measurement may be made with a high degree of accuracy it is necessary to set up the source of radiation, the wall, and the detector, in accordance with a predetermined geometric arrangement. The instrument automatically provides for this necessary arrangement. Furthermore, in order to convert the readings of the detector into wall thickness, the instrument must be calibrated on specimens of materials having known wall thicknesses from which calibration curves can be derived. These curves are supplied with the instrument for a given material, but different curves must be derived for other materials.

The accuracy of the instrument has been established as being within the range of plus or minus 3 percent. The measurement given is the average of an area of approximately 1 sq.in. so that pin holes cannot be detected. A time of approximately 25 sec. is required for each reading. Since the amount of back-scattered radiation depends not only on the wall thickness, but also on the liquid which may be backing it up, liquid level can be determined readily by moving the head along the wall of the vessel until a marked change in radiation is evidenced by the meter. By proper instrumentation, the Penetron may be adapted to control as well as to locate liquid levels. And since the back-scattering depends on the density of the material, the Penetron can also be used directly, without actual access to the fluid itself, in density measurements. Gravities in the range from 10 to 75 deg. Be. are said to be measured closely in this way.

The instrument proper, shown in the accompanying illustration, consists of two main parts, the head and the control box. The head contains the radiation source, the detector, and a shield between the two as well as a pre-amplifier. It is connected by a cable 75 ft. long to the control box which contains the measuring circuit and power supply. The head (the cylindrical portion shown) can be inserted into various types of holder which serve as supporting points for the head and at the same time hold it at the proper position with respect to the surface. One type, for example, has permanent magnets at the end to attach the head firmly to iron or steel surfaces. Another type, without the magnets, is also available. A pneumatic type holder with pistons moved by compressed air fluid pressure to secure the head in place can be used for measurement inside tubes.

Flexible pipe coupling



PIPE COUPLING

FASTER coupling of pipes, at lower cost and with greater flexibility, is claimed by the manufacturer, Drinkwater, Inc., 2323 South Michigan Ave., Chicago 16, Ill., for a new line of flexible pipe couplings to which has been given the name of Presto-Lock. These couplings are made in eleven sizes from 1¼ to 16 in. An important feature is that they can be used with any plain-end pipe without threads, grooves or flanges. No wrenches or special tools are required in assembly. Only a hammer is needed to tighten the wedge key shown in the accompanying illustration, after the two sections of the coupling have been fitted over the pipe ends.

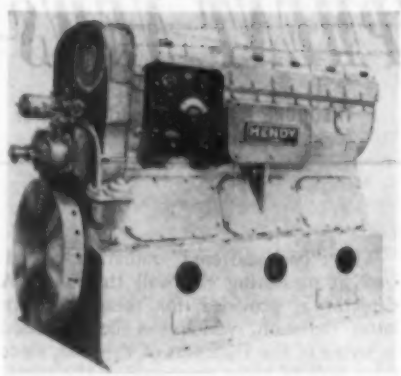
The coupling consists of two corrosion-resistant malleable iron castings, secured together by either one or two quick-locking wedge keys, depending on size. Within each of the castings is a special type of gasket available in synthetic rubber, neoprene, or natural rubber. Joints are designed to provide a flexibility of 40 deg. at each joint. In addition to coupling pipe, the Presto-Lock can be used to repair any leak which the coupling will cover. Pipes coupled in this fashion can be uncoupled simply by a tap on the wedge key. Pipes can be turned readily if necessary and any section can be removed without affecting the remainder of the line. Couplings are salvagable upon relocation of a pipeline and gaskets can readily be replaced when worn out.

Couplings of this type are extensively used, according to the manufacturer, for fuel, water and oil portable pipelines by the Armed Forces.

NEW DIESEL SERIES

TO EXTEND the horsepower ratings of its diesel engine line below the sizes presently available, the Joshua Hendy Iron Works, Sunnyvale, Calif., has added the new Series 20, consisting of six- and eight-cylinder models with a power range from

190 to 250 hp. at 900 r.p.m. Like other series of diesels made by this company, these engines are available in stationary industrial types, as well as in marine and diesel-electric models. The engines are of the four-stroke cycle type, designed for heavy-duty, medium-speed operations. They are air-starting and completely inclosed, provided with overhead camshafts, unit fuel pumps and injectors, precision type bearings and full pressure lubrication. They employ cast-iron, mono-block construction with underhung crankshafts, removable cylinder liners and auxiliary drives arranged at either end. The engines are entirely self-contained with all main accessories engine mounted. The attached accessories include air compressor, governor, water and lubricating oil circulating pumps, fuel transfer pump, lubricating and fuel oil filters, lubricating oil cooler and gage board. As these engines are designed for fresh water cooling, in instances where salt water or other inferior waters must be used, the fresh water system is close circuited and the water circulated through a heat exchanger and the engine, by means of a centrifugal pump.



190-hp. stationary diesel engine

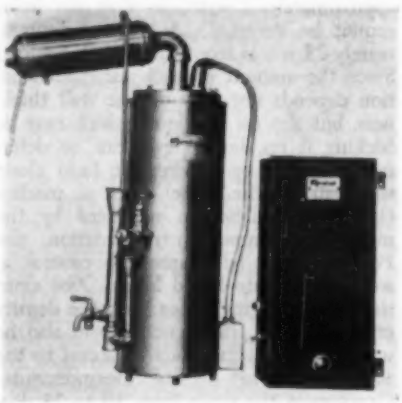
TRIGGER CONTROL

As in the case of the smaller sizes of carbon dioxide fire extinguishers manufactured by Walter Kidde & Co., 140 Cedar St., New York 6, N. Y., the larger portable models are now available with a one-hand trigger control which can be latched open when desired by a slight forward motion, and is easily disengaged to avoid wasting gas. It is claimed that the largest extinguisher requires approximately the same trigger force as the smallest. The new control is said to represent the end point of a long search for the best form of extinguisher valve. It is claimed to control discharge with a minimum of effort; to permit a high rate of flow of the carbon dioxide through avoiding directional changes in the flow passage in so far as possible; to allow easy locking in the open position; and to provide these advantages in a small, compact, light-weight design.

Extinguisher trigger valve

PROTECTED WATER STILL

Users of the electrically heated water stills produced by the Barnstead Still & Sterilizer Co., 5 Lanesville Terrace, Forest Hills, Boston 31, Mass., can now secure from this manufacturer a new floatless low-water cut-off, which automatically shuts off the electricity if the water level in the evaporator drops below a proper operating level. An important feature is a remote-control cabinet which may be mounted at any convenient place, regardless of the location of the still. At this point the still may be started and stopped and the cut-off reset. The device operates on alternating current and may be installed on stills now in operation. No moving parts are necessary in the still. Instead, the device operates by means of a weak electric current flowing through an electrode rod into the water in the evaporator. When the water drops below the end of the rod the circuit is broken and a magnetic switch operates to shut off the electricity. The relay and magnetic switch, starting switch, reset button, and a pilot light that indicates if the still is running, are included in the remote control cabinet. Similar floatless cut-offs are available for gas-fired stills.



Water still with floatless current cutoff

Smoke detector for ducts

SMOKE DETECTOR

For the detection of smoke in air-conditioning ducts, Photoswitch, Inc., 77 Broadway, Cambridge 42, Mass., has announced a new photoelectric system designed to sound an alarm, turn off blowers, operate automatic dampers, or provide whatever type of protection or control is required. The system consists of a photoelectric control and light source, the latter being mounted to project a beam of light over a distance from 10 to 25 ft. to the "eye" of the photoelectric unit. A sensitivity adjustment on the light source housing enables the user to adjust the photoelectric control to respond to smoke of a predetermined density. The instrument is designed so that either current or tube failure will cause the control to operate as though the light beam had been interrupted. Both units employed are available either in Underwriters'-approved explosion-proof housings for Class 1, Group D hazardous areas, or in weather-proof steel housings. Ordinary line power is employed.

CAST STEEL VALVES

Outside screw and yoke construction is employed in a new line of cast steel gate valves (also available in globe, angle and check patterns) which has been introduced by the Ohio Injector Co., Wadsworth, Ohio. These valves are said to have been designed for lower maintenance and feature a self-linking, two-piece gland and hinged gland eyebolts to save repacking time. The valves of this line are produced in a variety of trims, suitable for oil or oil vapor, steam, water, gas or air service, over a broad range of pressures and temperatures.

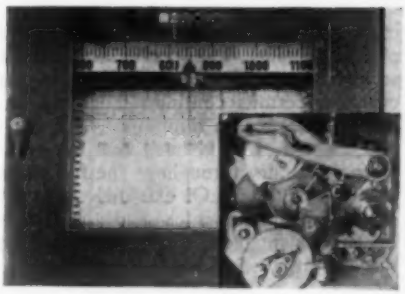
SELF-CLEANING FILTER

Primarily for the filtration of water, a new self-cleaning filter employing tubular filter elements and made in capacities up to 2,000 gal. per min., has been introduced by the R. P. Adams Co., Buffalo, N. Y. A large filtering area, up to 116 sq. ft., is obtained by mounting a number of tubular filter elements within a single pressure-tight case. The filtering elements are covered with fine-mesh Monel metal wire cloth. This filter employs an ingenious back-washing method for removal of the sludge that accumulates on the tubular elements during operation. A timing device, driven by a motor, operates a rotary valve distributor device which in sequence applies air pressure to a cylinder located below each filtering element. The pressure of the air moves a piston, closing the raw water inlet valve at the top of each element and opening a sludge discharge valve to the sewer. The filtered water then backwashes through the element and discharges the sludge from the bottom outlet. It takes only a few seconds to backwash each element after which the next element in the sequence is similarly treated.

HIGH-SPEED RECORDERS

DOUBLING the chart speed of its Electronik recorders is possible through an improvement recently announced by Brown Instrument Co., Wayne & Roberts Aves., Philadelphia, Pa. This improvement enables the chart speeds of this company's Electronik Pyro-Potentiometers, in both single- and multiple-point models, to be increased from the regular speeds of 5, 10, 15 and 20 in. per hr., to the corresponding doubled speeds of 10, 20, 30 and 40 in. per hr. It is anticipated that the availability of higher chart speeds will permit increased industrial use.

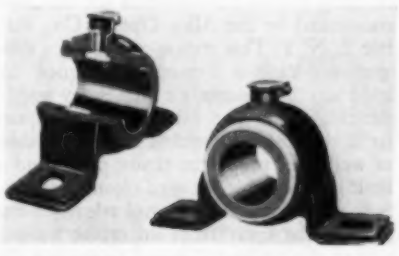
As shown in the accompanying illustration, the gears are changed by removing screw *C* from gears *A* and *B* and lifting the gears from the assembly. The new speed gears are then installed and screw *C* is replaced.



High-speed Electronik recorder

BRONZE BEARING

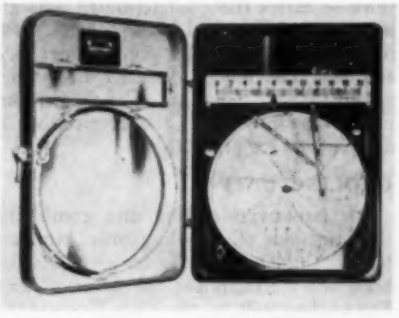
INTENDED for small shafts, and especially for fan and blower service, the new Type F Bronzoil bearing recently announced by the Dodge Manufacturing Corp., Mishawaka, Ind., is of self-aligning construction, provided with a capillary lubricator. The inner housing of the bearing is spherical to conform to a spherical socket in the outer steel housing. A bronze capillary bushing which carries about one-third of its volume of lubricant is used as a liner. This bushing is provided with a shoulder offering a broad, flat bronze bearing surface which is always lubricated, and serves to reduce friction between the bearing and the collar which positions the shaft. If desired, sound isolation can be provided by using Neoprene oil-resisting grommets in the mounting.



Small self-aligning bearing

POTENTIOMETER CONTROLLER

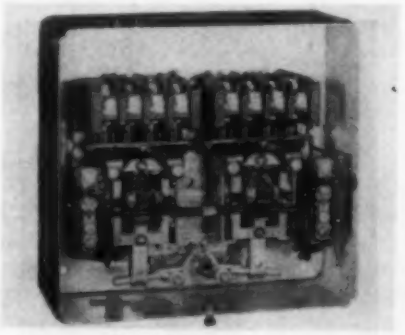
FIVE basic control unit types are available in a new series of electric-type potentiometer controllers announced by the Bristol Co., Waterbury 91, Conn. Three are electric contact instruments to be known as Microact controllers, the other two are electric proportioning and current-input types. The control units are mounted on the internal panel of a Pyromaster potentiometer recorder, and any type may readily be converted into any other type by following simple wiring and mounting instructions. The three Microact units are provided with one, two and three precision-type toggle switches, respectively, and six different terminal board connection arrangements, to meet a wide assortment of control circuit requirements. The proportioning controllers may be used with any type of electrical proportioning valve, and may be had with resetting contacts if required. The current-input controller, also a proportional type, is primarily designed to provide close temperature control for electric furnaces and ovens.



Electric type potentiometer controller

REVERSING STARTER

FEATURING a semi-interference-type mechanical interlock, a new a.c. magnetic reversing starter has been announced by the Industrial Control Division of the General Electric Co., Schenectady, N. Y. The starter is designed for full-voltage starting of squirrel-cage induction motors, and when combined with a reduced voltage starter can easily be used for reversing service. The new semi-interference type mechanical interlock prevents the closing of one contactor while an arc is maintained on the other, thus averting a short circuit through the arc and the resultant burned contacts and blown fuses. In addition, the interlock arm of the closing contactor assists the interlocking arm of the opening contactor in reaching its fully open position. Other features incorporated in the starter include under-voltage protection when used with a push-button station or other momentary pilot-circuit device; undervoltage release when used with selector or limit switches; and tamper-proof, self-contained overload relays, which allow the motor to operate to maximum safe operating temperature before tripping off the line. Dust-tight and water-tight inclosures can be furnished if desired.



Semi-interference-type starter

PORTABLE VACUUM GAGE

COMPLETE redesign of its McLeod type portable high-vacuum gage has been announced by the F. J. Stokes Machine Co., Philadelphia 20, Pa. Owing to the use of a built-in trap for condensible vapors, the gage is claimed to give accurate readings, within the micron range, even when such vapors as water, oils and alcohol are present in the vacuum system. This trap consists of a compact, renewable chemical cartridge which, by change in color of the chemicals, indicates when they are saturated and must be renewed. In most applications this would be only after several months of service.

Among other features of the new instrument are a simple device for fine adjustment of the automatic zero point; a shut-off valve to permit the gage to be kept under vacuum without danger of contamination when not in use; and special type fittings to minimize the amount of rubber tubing or other connections which could give rise to "outgassing" or leaks. Two models are available, one with a range of zero to 5,000 microns, the other with a range of zero to 500 microns.

Improved high vacuum gage

CHLORINE COMPARATORS

FOLLOWING a thorough study by its research department, the La Motte Chemical Products Co., Towson 4, Baltimore, Md., has introduced a complete new line of chlorine control units said to have effectiveness paralleling recently improved chlorination procedures. A new series of standards has been prepared of a size interchangeable with the regular La Motte pH color standards. An additional new development is the ortho tolidine-arsenite test which makes it possible to measure separately chloramine and active chlorine and, furthermore, to estimate the error that is caused by interfering substances. Included in the series is a chlorine colorimeter for low chlorine concentrations in the range of 0.02 to 0.3 p.p.m.; a chlorine block comparator for medium concentrations from 0.1 up to 1.0 p.p.m.; a block comparator for high chlorine concentrations from 1.0 to 10.0 p.p.m.; a wide-range comparator covering the range from 0.1 to 10.0 p.p.m.; and a Roulette chlorine

comparator covering this last range. The company is also prepared to supply combination pH and chlorine outfits.

VAPOR RESPIRATOR

U. S. Bureau of Mines approval under the newly established Schedule 23 has been accorded to a new chemical cartridge respirator for protection against low concentrations of organic vapors, recently announced by Mine Safety Appliance Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa. The respirator is intended to provide protection against vapors in concentrations up to 1,000 p.p.m. of such substances as acetone, alcohol, benzene, carbon tetrachloride, ether, formaldehyde, gasoline, and petroleum distillates, as well as toluene. The device employs a floating-cushion flexible face piece to assure a quick, gas-tight fit on persons of slightly varying special contour. Equipped with twin, replaceable, all-metal filter cartridges, the new respirator is said to assure comfort, low breathing resistance, and an easy fit. Extremely low resistance to exhalation is claimed. Simplicity of cleaning and maintenance are other important features.

SMALL WATER UNIT

Three small-capacity units for providing de-ionized water for laboratory and small-scale industrial use have been announced by the Illinois Water Treatment Co., Rockford, Ill. For several years this company has been building large de-ionizing units under the name of Illco-Way. The new small units include a portable size of 12 g.p.h. capacity, weighing only 35 lb., and larger units of 60 and 100 g.p.h, which are approximately 60 in. high, 30 in. wide, and 20 in. deep. It is claimed that these units are capable of producing water of substantially distilled quality at 1 to 10 percent of the cost of distilled water. Water produced by these units is claimed to contain less than 1 to 5 p.p.m. of dissolved solids (plus colloidal silica, which can be removed if desired).

ALUMINUM STOOL

Non-sparking aluminum alloy is employed in a new line of aluminum stools for industrial use, recently introduced by the Aluminum Ladder Co., 239 Carbis St., Worthington, Pa. For example, a stool made of hard alloy aluminum, 13 in. in diameter, 18 in. high and weighing 2½ lb., is being produced for use in powder plants. Castings at the bottom of the legs are brazed to insure a good ground connection, preventing the development of static electrical charges.

DUPLEX PRESSURE PUMP

Developed in collaboration with the Universal Oil Products Co., Precision Scientific Co., 1754 North Springfield Ave., Chicago 47, Ill., has introduced a new duplex high-pressure, variable-stroke pump intended for pilot plant operation, experimental pressure work, and many industrial applications. As appears from the accompanying illustration, the pump employs two separately driven cylinders capable of handling two different types of liquid simultaneously, or, where increased capacity is desired, both cylinders can be piped in parallel. The variable throw crank arrangement employed for driving the two cylinders permits continuous delivery adjustment between a minimum and a maximum stroke. It is claimed that the volumetric efficiency throughout the full range is over 90 percent. Of extremely compact design, the pump is claimed to be particularly adaptable to applications where space is at a premium.

GOGGLE CLEANER

A self-contained heavy-duty goggle cleaning station for industrial use has been announced by the Allen Optical Co., Buffalo 2, N. Y. This station comprises a steel atomizer cabinet especially designed for applying this company's Sani-Spray goggle cleaning fluid. The cabinet holds a quart jar of the spray material, which is refillable, as well as a supply of tissue paper and a built-in receptable for used cleaning tissues. A simple pushbutton control releases a fine mist of the spray from an orifice on one side of the cabinet. Pressure to operate the spray is provided by connecting the unit to the plant air line. An adjustable control valve regulates the predetermined amount of spray that is applied to the goggles. Cabinet contents are tamper-proof, under lock and key. The unit is compact and is designed for wall mounting. The cleaner employed not only cleans the goggles, but is also said to fog-proof them.

COOLING UNIT

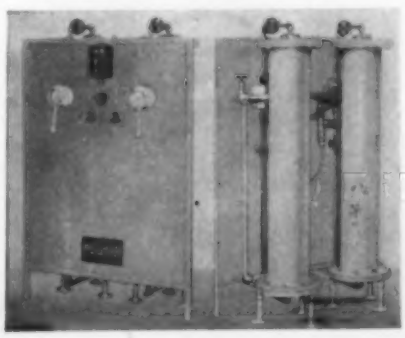
An improved cooling unit combining the principles of a cooling tower with extended surface heat transfer elements has been announced under the name of Fin-Fan cooling unit by the Fluor Corp., Ltd., Los Angeles 22, Calif. Cooled by forced draft, combined with water evaporation, these units are designed for pressures up to 5,000 lb. per sq.in., and temperatures to 1,500 deg. F. Installation of the tubes is made in such a way that these can be removed and replaced quickly. The tubes employed are the K-fin type made by Griscom-Russell Co. To insure flexibility, forced draft is provided by fans with variable pitch blades, powered by variable speed drives. Typical applications have been in gasoline plants; in the cooling of compressor stations, and in gas desulphurizing.

REFLECTIVE ROOF COATING

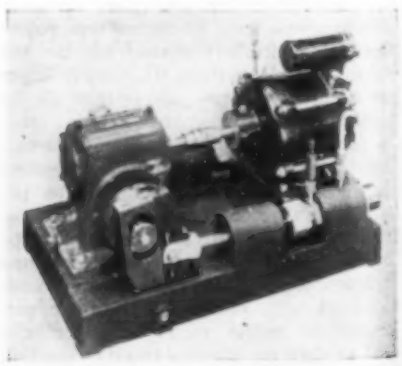
Material reduction in the absorption of solar heat by roofs is claimed for a new roof coating, Hornlume, recently developed by the A. C. Horn Co., 43-36 Tenth St., Long Island City 1, N. Y. The manufacturer points out that although asphalt has been for many years one of the best roof coating materials, its resistance to solar radiation is not good. To overcome this difficulty the new coating combines asphalt and aluminum. The aluminum rises to the top when the coating is brushed on the roof, while the asphalt sinks beneath the aluminum and bonds to the roof. Whereas a black roof reflects about 6½ percent of the incident solar radiation, a Hornlume roof is claimed to reflect about 72 percent, resulting not only in protection of the asphalt itself against the radiant energy, but also in reduction of heat absorption to such an extent that differences as great as 22 deg. F. between the upper and lower roof surfaces have been noted. It is also claimed that roofs treated with this new material have stood up much better than plain asphalt roofs, free from checks and cracks.

Approved chemical cartridge respirator

100-g.p.h. water de-ionizing unit



Duplex variable-delivery pump



Goggle cleaning station

REPORT ON.....

INTEGRATION

Of Chemical Plant Facilities

Most chemical plants, especially in long established industries, have grown pretty much like Topsy. One manufacturing unit or department after another has been added on the existing structures or built on a nearby site where management could keep an eye on it. There it shared general plant facilities for power, water, etc., and at the same time permitted interchange of materials in process. This problem of integration, i.e., of "tying together" related manufacturing operations, can, however, find a more efficient solution if new plant construction is done on the basis of logical long-range planning. A good example of that sort of industrial integration will be found in Hercules Powder Co.'s ethyl cellulose development at Hopewell, Va., which will be described in text, pictures and flowsheets.

It was by no mere chance that Hercules Powder Co. became interested in ethyl cellulose some years ago. From its very inception cellulose materials have represented a large proportion of the company's business. Nitrocellulose was one of its first products, and at the present time this material is made in larger volume than ever before for both smokeless powder and for coatings. Not long after the company was organized its officers realizing the advantages to be gained by having its own source of chemical cotton acquired a cotton linters purification plant at Hopewell, Va. In the nineteen thirties when the plastics industry was adding another cellulose base material to its growing list of products Hercules acquired and developed a unique method for the production of cellulose acetate resulting in a product of which the company is justly proud.

As long ago as 1927 Hercules had become interested in the cellulose ethers, and during the following year sent three chemical engineers to Germany to investigate that country's knowledge of cellulose compounds in general. During the several years that these engineers were in Europe they looked into the development of ethyl, methyl, and other cellulose chemicals. In 1934, a second trip was made to Germany. From the knowledge acquired in that country and from Hercules' own development work, a pilot plant was designed and put into operation in the fall of the year for production of benzyl cellulose and another the following year for ethyl cellulose.

The management early recognized that ethyl cellulose was destined to become an important raw material in the plastics and protective coatings industries. And as one after another of the difficulties of production were met and mastered, the decision was made to proceed with the expansion of manufacturing facilities. A full-scale plant was built at Hopewell just one year after the completion of the original pilot plant. Since that time the history of the ethyl cellulose plant has been one of rapid growth. Three times in the brief period the company has undertaken new construction programs, the most recent of these expansions has just been completed.

When ethyl cellulose was first introduced into this country by Hercules, the market was limited to a compound for marking the size, wool content, maker's name, and the like on hosiery. It could only be used for purposes where a little went a long way for the price was $2.50 per lb. When Hercules got its own plant in production thus establishing a domestic source of supply prices came down rapidly to $1.50 and later to 50c. per lb. This downward trend in the price curve was accompanied by a broadening of the market to protective coatings and lacquers.

Then came the war and the enormous demand for plastics. An application that

had thus far been comparatively little known almost overnight took on new importance. As the necessity for plastics has developed with the war, more and more ethyl cellulose has gone into this application until at the present time 70 percent of the output is being consumed as plastics, while only 30 percent goes into compounding of protective coatings.

PRODUCTION

When the decision to construct a plant for the production of ethyl cellulose was reached the management selected Hopewell for its location. The company already had large acreage there and was producing the principal raw material, purified cotton linters. The location also afforded other essential facilities—deep water and rail transportation for incoming linters, caustic, salt, sulphuric acid, and other supplies, and outgoing shipment of the finished products; a mild climate with an open winter; adequate water from the James River; and a plentiful supply of intelligent labor, white and colored.

INTEGRATION OF FACILITIES

The ethyl cellulose operations is one of the finest examples of industrial integration of chemical manufacturing facilities to be found anywhere in this country. The buildings in which the cellulose is converted to ethyl cellulose are in the center of operations. Surrounding them are the various units used for producing the raw materials, for recovering the solvents and other by-products for reuse, and for storage and shipment of raw and finished materials, power house and other auxiliary facilities.

The entire development is divided into five main sections; namely, (1) management and laboratories, (2) ethyl cellulose manufacture, (3) cotton linters, (4) heavy chemicals, and (5) solvents. The arrangement of operations was dictated partly by necessity for conveying materials from one to another, but primarily for purposes of safety.

An installation of 72 Hooker Type S cells supplies caustic and chlorine to the linters plant. The former is also used for wetting the cellulose in the ethylation plant, while the latter is available should it be necessary for use in producing ethyl chloride.

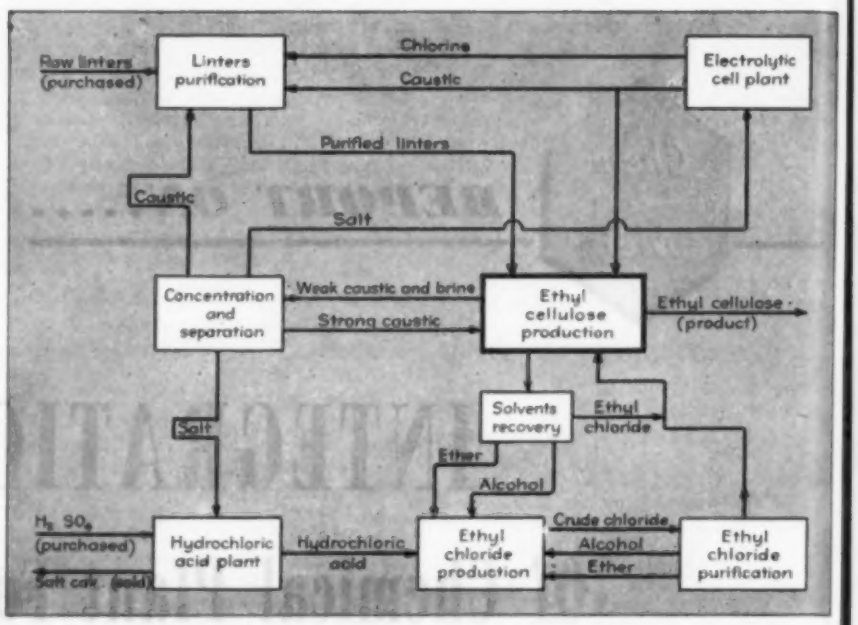
The chemical cotton plant uses the caustic and chlorine from the adjoining plant in treating the raw linters. These linters are one of the very few materials that must be purchased from the outside. The purified linters are the principal raw materials for the ethyl cellulose manufacture.

Byproducts from the ethyl cellulose production are weak caustic, salt, alcohol and ether. In the caustic building the first of these is recovered, purified, concentrated and its strength adjusted for use in either the electrolytic cell plant or the ethyl cellulose plant.

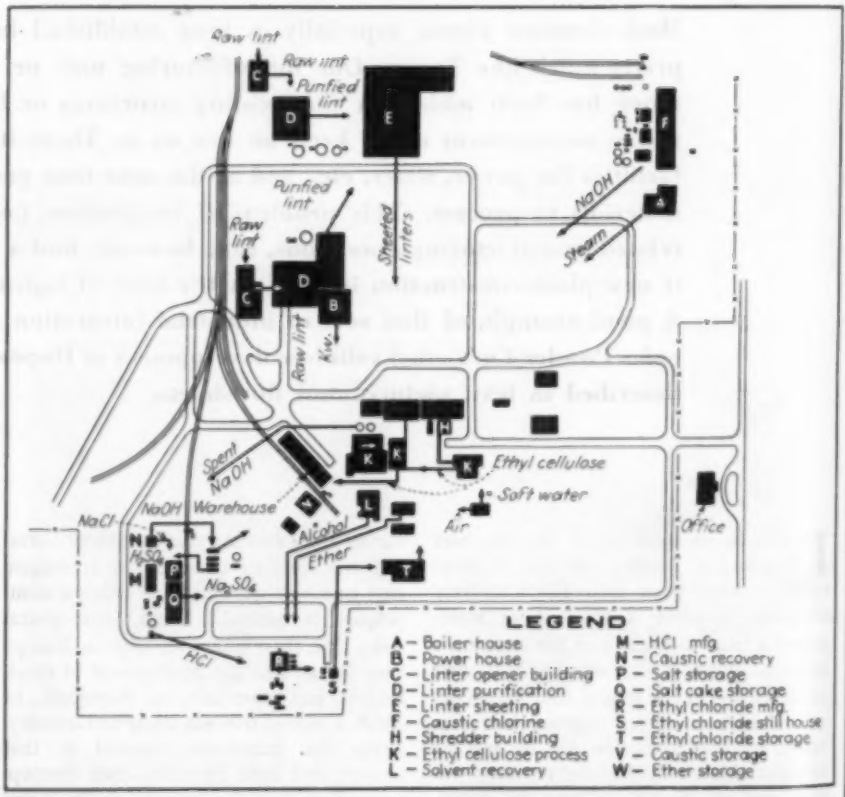
Salt is separated from the other by-products and conveyed to the hydrochloric acid unit where it becomes a raw material. If necessary it could also be used in the electrolytic cell plant.

In the hydrochloric acid plant the by-product salt, and if necessary purchased salt, is treated with sulphuric acid from an outside source to form hydrochloric and salt cake. The latter is a byproduct for which no application has thus far developed in the operations.

Hydrochloric acid is used in the ethyl chloride plant for treating alcohol and ether, byproducts of the ethylation reaction



Flowsheet of ethyl cellulose production; see also pp. 138-141 of this issue



Map showing location of buildings at the Hercules Hopewell Plant

Ethyl cellulose slurry is spun in automatic discharging centrifuge

in the ethyl cellulose plant. The product, of course, becomes a raw material in the ethyl cellulose operations.

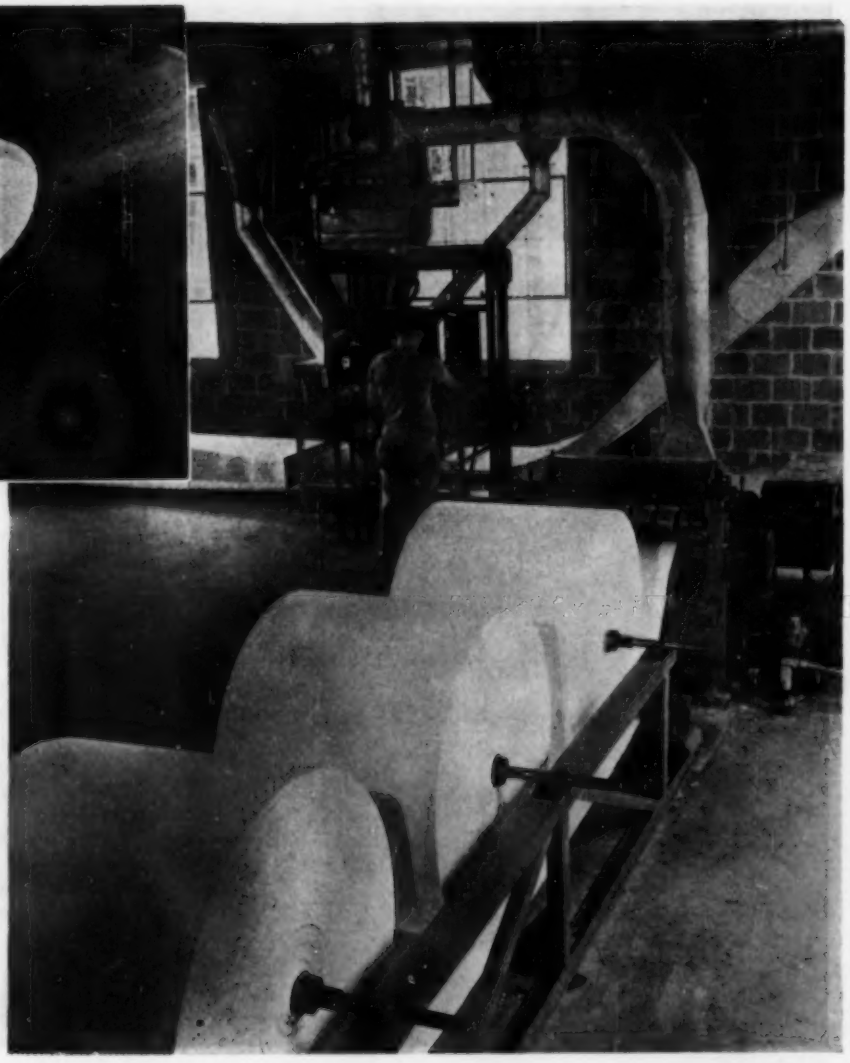
About the only byproduct in the entire plant which is not consumed somewhere in the development is the salt cake from the hydrochloric acid operations. This is sold to the sulphate pulp industry.

Certainly the Hercules engineers have designed an almost perfectly integrated operation. And plans for additional operations at the Hopewell development that they now have on the drawing boards will make for even greater perfection.

ETHYL CELLULOSE PRODUCTION

The process employed for making ethyl cellulose consists of moistening cellulose with caustic soda and treating the alkali cellulose with ethyl chloride under heat and pressure. The resulting product is separated from the organic solvents and other products of the reaction, washed, purified, ground, dried, and packaged for shipment.

Although the plant started operations with purified cotton linters as the cellulose raw material it was designed with flexibility for handling sulphite pulp as well. Choice of materials depends upon the relative costs of the two sources. In fact, both types were being used on the day the plant was visited. The sheets of chemical cotton are brought to the processing unit from the adjacent plant of the Virginia Cellulose Department of Hercules Powder Co. Here the rolls of sheeted chemical cotton and sulphite pulp are stored in a warehouse near the main processing building. As the cellulose is required the rolls are brought into the closed section of the building nearest the processing operations. Here the sheeted cellulose is passed through a Stern shredder and blown to the top floor of the processing building. Shredding is done in the closed room of the warehouse as the operation is somewhat dusty.



Stern shredder produces thin, narrow thread-like lengths from felted cotton linters or wood pulp sheets. They are blown to processing building

The shredder received special attention a year or two ago when its inventor, Raphael L. Stern of the company's Parlin, N. J., plant received a Citation of Merit from the U. S. Army Ordnance Department for his contribution in making it practical for the Army to use wood pulp economically in the manufacture of smokeless powder.

The shredder produces thin, narrow thread-like lengths from felted cotton linters or wood pulp sheets by chipping or cutting and splitting, forming loosely felted fibers. The wood pulp fibers can be readily, uniformly, and economically ethylated in the same length of time and under the same conditions as those used for treating cotton linters.

Shredded cellulose enters a covered horizontal, Monel-lined trough, or as it is sometimes called "wetter" where it is moistened by a spray of caustic. Both recovered byproduct caustic and purchased caustic are used. The iron-free caustic comes to the plant at high concentration. It is given extremely accurate adjustment and stored in plain carbon steel tanks. It is then pumped to weigh tanks in the processing building as required for each individual batch of cellulose.

Wetted material moves along in the Monel screw conveyor above the reactors. By means of a sliding door in the bottom of the conveyor and above each reactor the alkali cellulose can be charged into any one of the many vessels along the line. These steam jacketed autoclaves are 4,500 gal. vessels, tested to 700 lb. per sq.in. They are nickel lined and equipped with shafts and agitators of the same metal.

On the bottom of the vessel is a plug discharge valve especially designed for hydraulic operation. It is ingeniously tied in with other controls so that it cannot be opened while pressure is in the vessel. To make doubly sure this does not occur there are two padlocks on each valve. The key for one of them is kept by the foreman;

From bins the dried granular ethyl cellulose is packed into corrugated paper cartons with an inner bag liner and having a capacity of 50 lb. each

the key for the other is held by the operator. Both men must be on hand when the valve is opened. There is a solenoid valve in the ethyl chloride inlet line which cannot be opened so long as the discharge valve on the bottom of the autoclave is open.

The lantern type packing gland is packed both above and below, and is continuously lubricated. The asbestos packing is water cooled to extend its life. The packing gland is designed to withstand caustic, salt, ether, alcohol, and ethyl chloride under pressure.

Ethylation is a batch process. When the autoclave is charged the temperature is raised to a point somewhat below 400 deg. F. During the reaction cellulose and caustic compete for the ethyl group of the ethyl chloride resulting in formation of ethyl cellulose, ether, alcohol, and salt. Both temperature and pressure are carefully controlled for they govern the volumes of these materials in the batch at the end of the reaction. Other operating variables include raw materials and length of time of reaction. For every 100 lb. of cellulose charged, there is produced 125 lb. of ethyl cellulose. For each autoclave there is an instrument board with recording and indicating instruments for temperature, pressure and power.

By controlling the operational variables of temperature, pressure, selection of raw materials, and length of time of reaction Hercules produces ethyl cellulose of a wide range of ethoxyl content and viscosity to customers specifications.

When the processing cycle in the reactor is completed, the ether and alcohol formed during the ethylation are flashed off through lead-lined scrubbing equipment, and carefully scrubbed with sulphuric acid to remove harmful low-boiling contaminants. The solvents are then condensed. The low wines flowing from the condensers are collected in storage tanks. Later these solvents are fed to a series of copper still columns where minor volumes of unreacted ethyl chloride are recovered for reuse in the ethylation reaction, and the ether and alcohol are separated and recovered as such for use in ethyl chloride production. Inasmuch as this operation is considered an alcohol production unit the entire handling of alcohol is carried out under supervision of the Tax Unit, Internal Revenue Department, U. S. Treasury.

Considerable refrigeration equipment is necessary in order to supply this operation with relatively large quantities of ice water for condensation equipment. Vents from various solvent storage tanks in the area are all conducted to a final vent condenser to minimize solvent losses.

As the solvents are removed from the reactor ethyl cellulose precipitates in a liquor consisting of caustic and brine. The slurry is discharged through the plug valve on the bottom which has been previously described. It is blown to receiving tubs on the top floor where caustic is drained off. This weak caustic solution carrying saturated salt is pumped to the salt recovery building which will be described later. The salt in the slurry which is not carried off by caustic is washed out by water sprays.

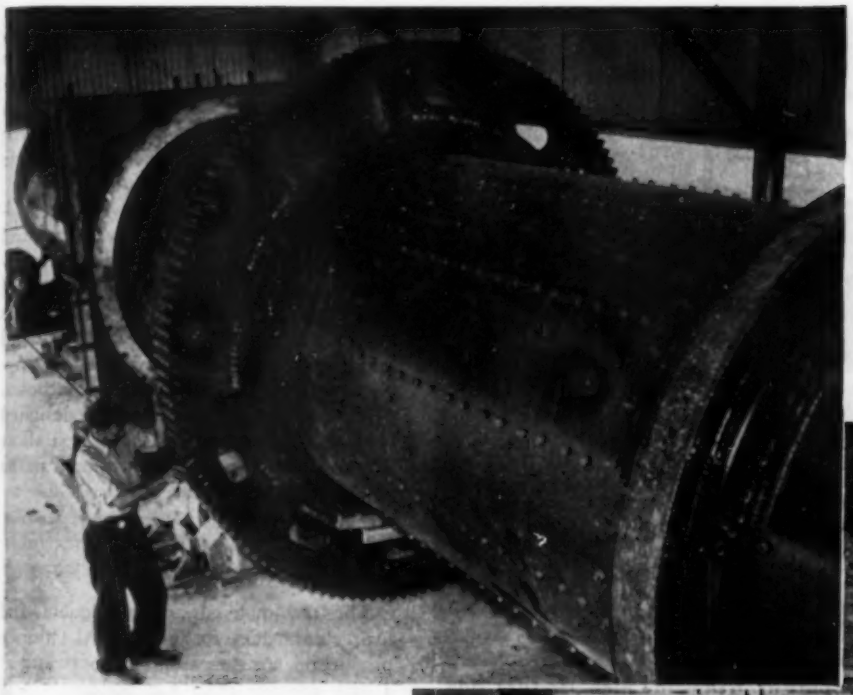
Ethyl cellulose in rather large granules is dropped into hammer or knife cutter mills in which it is ground to uniform size. As this grinding action opens the granules salt and caustic are exposed. Therefore, it is necessary to drop the granules of ethyl cellulose into a wash tub equipped with a nickle-screen false bottom, where by means of water and agitation they can be washed. The weak brine and caustic leaving the wash tub are discharged, but the fines are recovered. The product is then given a special treatment for purification.

The water slurry of purified ethyl cellulose is pumped to a Monel-lined feed tank with an agitator of the same metal on the top floor. The clean product is discharged into a centrifuge where the water content is lowered to 45-50 percent. The fines are recovered. The partially dried product is dumped into a bin below which is located the dryer. This dryer reduces the moisture to ½ percent.

The dried ethyl cellulose is discharged into bins. From these bins the granular product is packed into corrugated paper cartons with an inner bag liner and having a capacity of 50 lb. each. The filled cartons are carried by a roller conveyor through a sealing and labeling machine, and to storage in the adjacent warehouse.

SALT RECOVERY OPERATIONS

Now let us go back and pick up the weak caustic solution carrying saturated salt that is removed from the slurry leaving the ethylators. This solution is fed into a double-effect, nickel-lined zaremba evaporator and brought up to 50 percent strength. This concentration throws out salt, which is further augmented by salt thrown out of solution when the caustic is cooled to normal temperature. All of the strong



HCl is made by reaction of H_2SO_4 on salt in a Laury-type furnace

caustic is chilled and pumped through Bird continuous centrifugals where the salt crystals are separated from the liquor.

These crystals are carried in a brine slurry to a continuous rotary vacuum filter. Here the occluded caustic is washed out and returned to the weak supply and the caustic-free salt is discharged to screw conveyors. These conveyors take it to wet salt storage or to salt dryers for direct feeding of the hydrochloric acid furnace.

More than sufficient salt is formed in the reaction to supply the entire salt requirements for the hydraulic acid necessary to convert byproduct ether and alcohol to ethyl chloride.

ACID PLANT

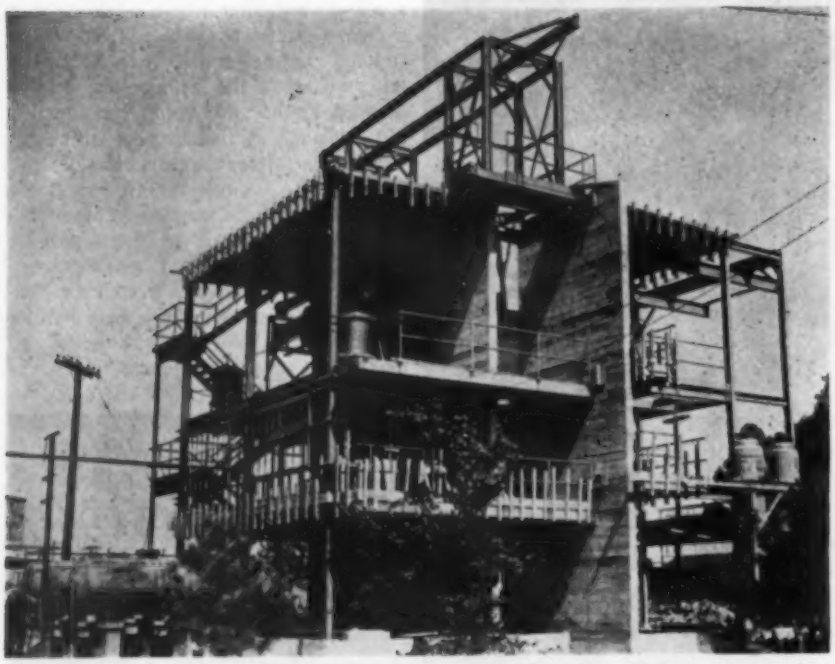
Hydrochloric acid is made by reaction of sulphuric acid on salt in a Laury-type furnace modified by several Hercules improvements. The furnace is larger than others in use. Salt and sulphuric acid are fed in at one end of the rotary, oil-fired furnace, and salt cake leaves at the other end. Hot hydrochloric acid is removed by means of either a steam or electrically driven fan at the tail end of an absorbtion train. Salt cake spills out of the furnace and is cooled in a rotary water-jacketed cooler on the floor below from which it is transferred by bucket conveyors to storage at the railway siding. The salt cake is sold to the sulphate pulp industry.

Hot hydrochloric acid gases are passed through a cyclone separator and thence through acidproof brick cooling towers and a coke-packed filter where sulphuric mist is removed to absorbtion towers constructed of Haveg and Karbate. After careful purification the hydrochloric acid is pumped to the ethyl chloride production plant where it is used to react with ether and alcohol to produce ethyl chloride.

Outstanding feature in this unit is the large volume of gas handled within a relatively small area by means of generous use of the synthetic resin and impervious carbon equipment. Carbon is used for cooling coils because of its high heat transfer coefficient and the resin for housings and other parts of the equipment because of

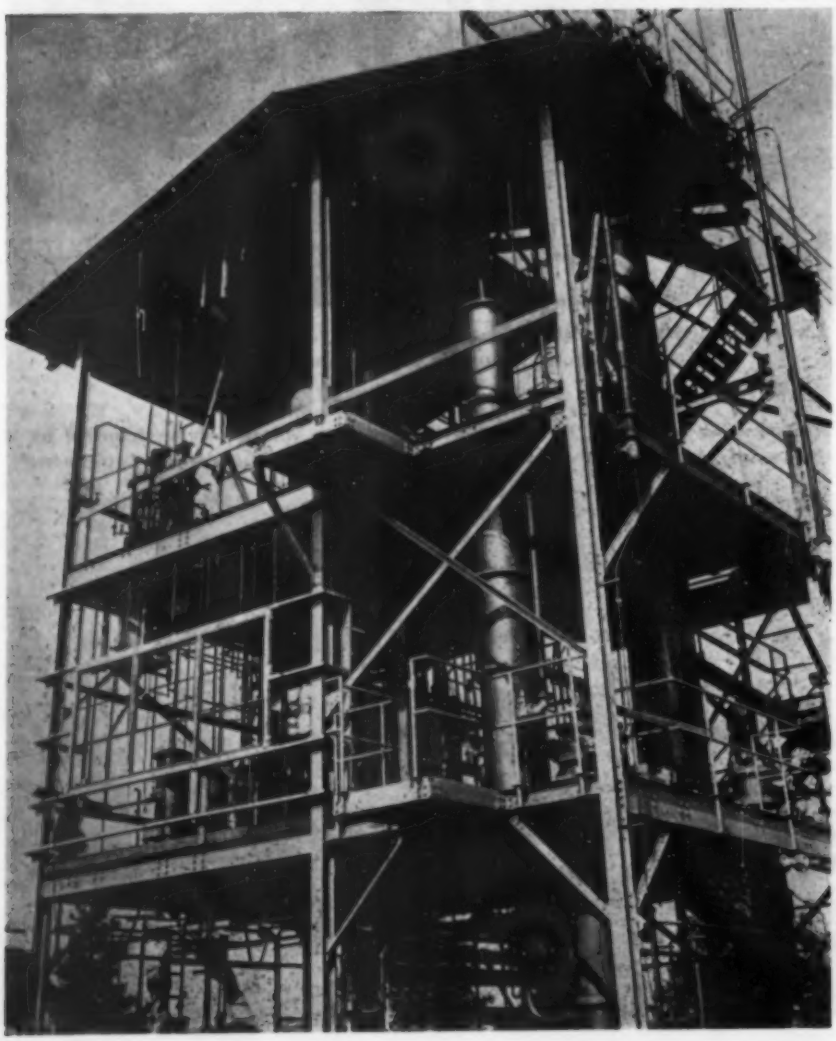
Under construction in the HCl plant are the absorbtion towers made of synthetic resin and impervious carbon

Outstanding feature of the HCl unit is the large volume of gas handled by means of generous use of synthetic resin and impervious carbon equipment



A concrete firewall will protect the low-pressure from the high-pressure side in this ethyl chloride converter building when in operation

Construction view of the separating columns for ether, ethyl chloride, and alcohol in the solvents separation unit



its corrosion resistance. Necessary tanks, fans, and the like are rubber lined. Gas lines are resin. All steel equipment is protected by acid-resistant coatings. Pumps are non-stuffing box type made of Haveg with Hastelloy B trim. Valves are made of this same alloy.

The building is steel with Transite siding but is open on the furnace and ground floors for purposes of cooling and ventilation. Such wood as is used for decking and platforms around the hydrochloric area is of a special impregnation for both fire and acid resistance. Pumps and fans are supplied in duplicate for emergency purposes. The metallic equipment has been designed so that parts known to have only a short life due to high rate of corrosion can be quickly and easily replaced.

ETHYL CHLORIDE

The raw materials, ether, alcohol and hydrochloric acid, for use in ethyl chloride production are stored out of doors and at a safe distance from the building. Acid storage tanks are glass lined and the solvents tanks are steel.

The acid is pumped to the building and vaporized in glass-lined equipment, mixed with ether or alcohol (each system being separate) and together fed to reaction vessels under a few atmospheres of pressure where conversion to ethyl chloride takes place. The vaporized product leaving the reactor consists in one case of ethyl chloride, and small volumes of ether, ethylene, water, and traces of hydrochloric acid, and in the other case of ethyl chloride, and small quantities of alcohol, ethylene, water, and traces of acid. These products are passed through glass-lined scrubbing towers in order to remove acidity. They are then condensed and collected as an impure mixed solvent for transfer to the solvents separation building.

The ethyl chloride production building is constructed of steel and concrete. It is so designed that all glass-lined pressure vessels are separated from one another and from the operator by means of concrete fire walls. The building siding was eliminated so that for all practical purposes this equipment is operating in the open air.

Necessary flow gages, and temperature and pressure controls have been brought to a central location where the operator can observe all the instruments and operate all controls from behind a thick synthetic resin window in one of the fire walls.

In addition to the glass-lined pressure vessels, the special equipment includes porcelain and Hastelloy B valves, glass-lined piping and many control instruments. Copper equipment is used for all condensing and handling operations beyond the point in the operations where acidity is scrubbed from the vapors.

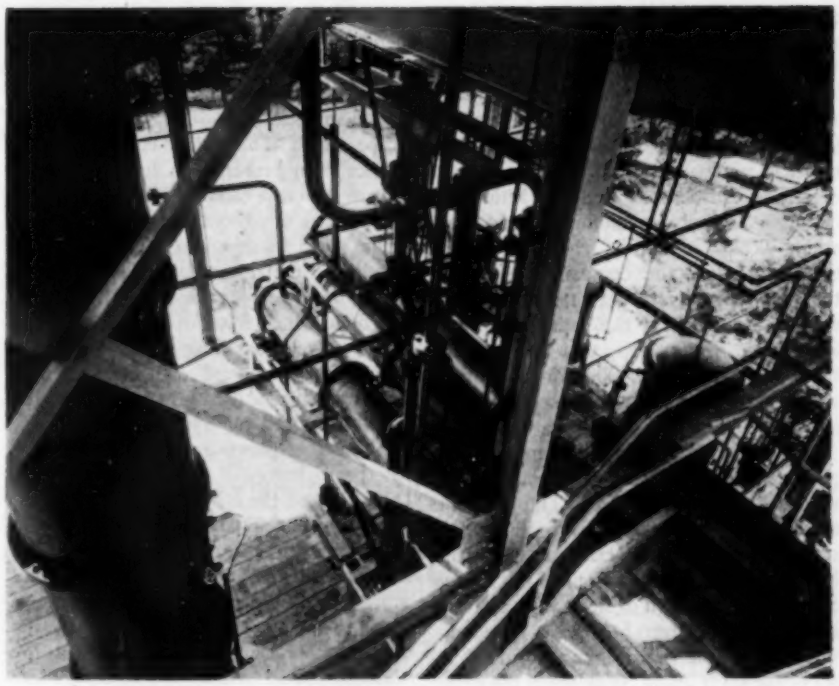
Impure mixed solvents, products of the ethyl chloride building, on reaching the

solvents separation building, also located in the solvents area, are fed in the one case to the ether still column and in the other case to the alcohol column for separation of the ethyl chloride from unreacted components. Unreacted ether and alcohol are returned to the ethyl chloride reactor building while the ethyl chloride is collected and transferred to storage tanks in which it is kept under pressure in the process area for use in the ethyl cellulose reactors. For purposes of safety siding was omitted in constructing the building in which the pressure storage tanks are located.

The solvents separation is housed in a tall steel and concrete structure with some little Transite siding. However, an interesting feature is the fact that about 85 percent of the building is open to the atmosphere. This open type of construction prevents the formation of pockets of gases.

At the linters plant the purification treatment consists of both mechanical and chemical means. Bales of linters are knocked apart, cleaned and fluffed up in a "devil duster." The brownish cotton is then treated with caustic soda from the electrolytic cell plant, or if it should be necessary from the recovery operations, at elevated temperature and pressure in a digester in order to put the hulls, oils and waxes in soluble form. The mass is then washed in steel tanks. The bleaching operation, in which chlorine from the cell plant is used, is carried out in multiple stages. The pH is closely controlled. Bleaching is modified to meet the specifications required for the finished linters. After washing, the clean cellulose flows into a storage tank and from there to the drying or sheeting departments. Linters destined to be converted into ethyl cellulose are pumped to the sheeting department. Here they are blended, refined in jordans, and made into sheet pulp in rolls on a fourdrinier paper machine. The rolls are stored in a warehouse near the ethyl cellulose manufacturing units.

Only a part of the output of this linter plant is consumed in the ethyl cellulose development. Much of it is shipped elsewhere to serve as a raw material in the production of smokeless powder, rayon, lacquers, film, plastics, artificial leather and dynamite. (See *Chem. & Met.*, Apr. 1941, pp. 90-91 and 108-11 for description, photographs and flowsheet of this plant.)



Ethyl chloride recovery building showing still columns and condensers where the ethyl chloride is separated from unreacted ether and alcohol

Back of control panel in the ethyl chloride recovery building. Flow gages, and temperature and pressure controls have been brought to a central location

MATERIALS OF CONSTRUCTION

In an effort to obtain an extremely pure product, an effort in which Hercules has been very successful, many precautions have been taken. Buildings have been provided with more than usual window space to provide maximum light. Interior walls have been finished with white paint presenting one of the brightest and cleanest plants this writer has ever observed in the chemical industry.

In order to prevent contamination of the product and corrosion, all equipment in the ethylation plant, including treating tubs, pipe lines, pumps, purification vessels, centrifugals and dryers, are either nickel or Monel, solid or lined. When high-strength caustic (30 percent) or high temperatures are used nickel equipment, either solid or lined, was chosen. But in all other instances, Monel is satisfactory. These include the tank and agitator feeding the centrifugals. In all, this plant contains the grand total of approximately 100 tons of these two metals.

During one of the earlier expansion programs the supply of nickel in the United States was quite inadequate to take care of all essential military uses. Although ethyl

cellulose was considered a highly important strategic material, it was concluded by the War Production Board that nickel would be unavailable for additional ethylation autoclaves. Silver had not been proved for this use but it was known that this metal is reasonably resistant to the action of strong caustic soda and the action of corrosive solvents including mixtures of ether, alcohol and ethyl chloride. With this knowledge, the company concluded that the only way to get further facilities was to use silver as the lining for their autoclaves. This step was taken and three of the largest (4,500 gal.) silver-lined autoclaves ever built were fabricated and installed.

Since the vessels were to operate under pressure, the silver had to be backed up with a heavy shell of steel. The problem of attaching the steel to the silver presented a most difficult task but successful bonding was eventually attained. The coefficient of expansion of silver is sufficiently different from that of steel so that considerable trouble was encountered in cracking of the silver lining. Welding of the silver shell under the circumstances proved difficult but was finally solved by atomic hydrogen welding. It was necessary, however, to develop a special technique for carrying out this job.

Silver-lined autoclaves cause considerably more trouble than nickel-lined vessels from the standpoint of maintenance. However, the installation of silver-lined autoclaves has permitted the manufacture of several million pounds of ethyl cellulose which would not otherwise have been available.

SAFETY

Safety, obviously, was uppermost in the minds of the engineers when designing the plant at Hopewell. Throughout the entire layout can be seen the influence of many years of experience in combating the hazards involved in the manufacture of explosives. To the casual observer it appears that every known safety device has been brought to bear on the hazards associated with the handling of solvents, acids, alkalis and other chemicals in an effort to make the plant a safe place in which to work.

When the layout was made, the hazardous operations such as solvent recovery, solvent storage, ethyl chloride production and cellulose ethylation were widely separated and in isolated areas. These areas are posted with sign boards at every approach giving warnings of the dangers. Trucks and other gasoline burning motor equipment are forbidden in the areas except under special circumstances in which cases the operators must first obtain permits.

Concrete fire walls separate the several ethylation units and every reaction vessel in the ethyl chloride building. Sidings on the buildings have been omitted where there is even possibility of the formation of pockets of gas. The buildings are equipped with either safety chutes, familiar around smokeless powder plants, or built-in escape stairs. To prevent cuts and other injuries from broken glass in case of accident in the ethyl cellulose processing buildings where explosions conceivably might occur, glass window panes have been replaced by metal screen. These screens were previously treated with ethyl cellulose dope which filled in the webs. Floors in the solvent handling areas and in the laboratory are covered with static-conductive Hubbelite. All buildings are protected by a fire sprinkling system.

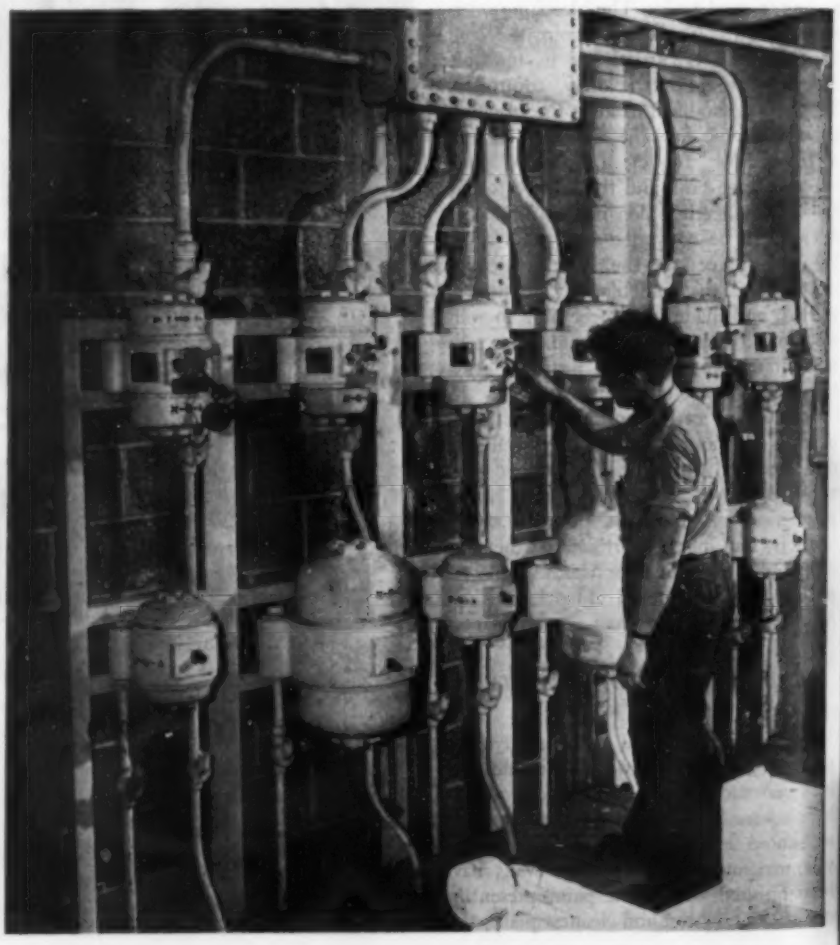
From the petroleum refining industry has been borrowed the idea of dikes. Dikes around the ether and ethyl chloride storage tanks could retain these solvents in case of breaks or accidents. All autoclaves are provided with safety pop valves and rupture disks. In case a charge gets out of control and the pop valve fails the disks rupture and allow pressure in the vessel to release through the discharge line into a solvents pit several hundred yards from the buildings. The pit is equipped so that the pressure can be lowered quickly and thus brought under control. Pop valves and rupture disks are also used on solvent storage so that excessive pressure can not build up.

In the packaging department where the air contains fine particles of ethyl cellulost, the weigh buggies, lift trucks, and the like are grounded to prevent static sparks.

Above all solvent tanks are sprinklers. In addition, above these tanks are fog nozzles that have become familiar because of their use in this war for extinguishing fires on airplane carriers. These nozzles provide a fine spray of water which keeps tanks cool and the fire down. A portable 750-lb. refrigerated bulk carbon dioxide unit is available for use in case of solvents fires. In addition, there is a system which in case of fire is connected with the water mains and creates a foam blanket. And such equipment is provided as rubber gloves, safety showers, non-sparking bronze tools, non-sparking metal flooring on scales.

This is one of the most completely integrated operations in the American chemical industry—at least as far as this writer's observations are concerned. From it comes a material which, although comparatively new to the industry, already has shown a remarkable record of growth. It further strengthens the position of Hercules Powder Co. in the industry as a leading producer of cellulose products.

Throughout the hazardous area are vapor and explosion-proof lighting fixtures, starting switches, motors, pumps, circuit breakers, and controllers



CASH STANDARD Streamlined PRESSURE REDUCING VALVE TYPE 1000

STRAIGHT LINE FLOW

DOES THE JOB THAT DOES THE MOST FOR YOU . . . . . .

THE "1000" with its large capacity, tight closing characteristics, close delivery pressure control, and wide range of adjustment, gives you smooth operation, speedier production results, and no spoilage. The "1000" will fit your job and even though you have tough operating conditions this streamlined valve will iron out long standing valve problems.

This design is the reason for **STRAIGHT LINE FLOW**

1. Steam, water, air, oil, etc. flow through this valve in a straight line—nothing is in the path of flow to cause turbulence—therefore, peak flow is never a problem.

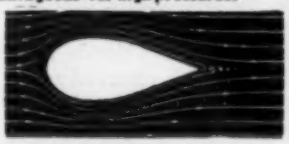
2. Inner valve is streamlined—no back eddies to hinder flow (see streamlined form above)—valuable when you want all possible fluid to go through the valve to meet peak demand.

3. Turbulence is

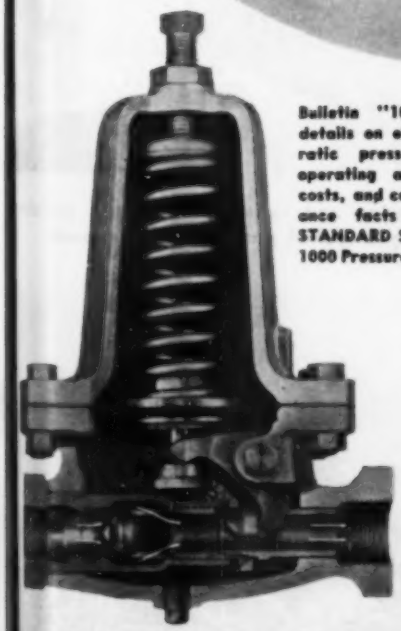
eliminated

even in the venturi approach to the valve seat. It means better flow. The inlet pressure is confined to the small cylindrical venturi chamber, the same being advantageous for high pressures.

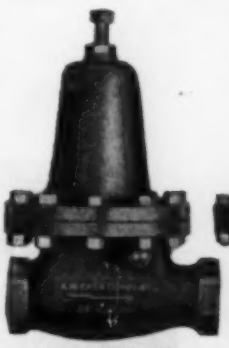
YOU GET THIS



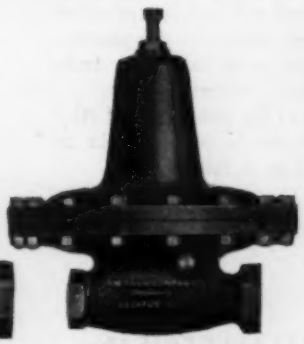
STREAMLINED FLOW



Bulletin "1000" gives you details on elimination of erratic pressure, saving in operating and maintenance costs, and complete performance facts of the CASH STANDARD Streamlined Type 1000 Pressure Reducing Valve.



Type 1000—HP
Normal size diaphragm. Made for high delivery pressure.

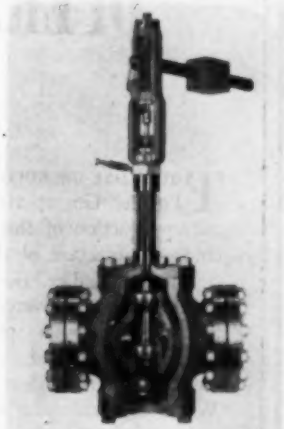


Type 1000—LP
Has large diaphragm. Made for low delivery pressure.

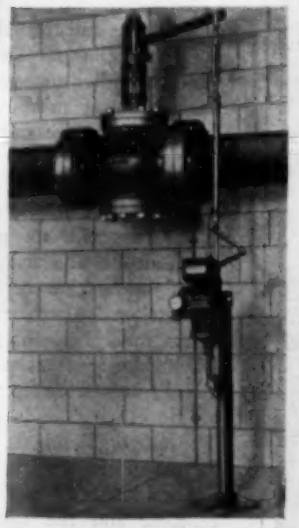
CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

OTHER VALVES from the CASH STANDARD LINE



Cash Standard Balanced Valves, Series 42, have no lost motion. Have roller guides that kill side strains; stop packing trouble. Practically no maintenance. Sizes ½" to 12"; pressures up to 600 lbs. temperature to 800° F. Bodies: iron, bronze, steel; all standard trims. With Air Cooled Packing Box (42-AC-R) shown above; or water cooled; or no cooling box. Made also with center guide. Bulletin 965.



The Cash Standard Type 100 Controller above is operating an 8" Type 42-R Balanced Valve, automatically reducing 250 lbs. down to 125 lbs. pressure, handling 200,000 lbs. steam per hour. Type 100 Controllers have lots of operating power, enough for any size valve; are fully compensated; have adjustable range; are very sensitive. Bulletin 963 covering the Controller and Bulletin 965 covering the Valve give complete and interesting details. Write for them.

ETHYL CELLULOSE OPERATIONS

THE ETHYL CELLULOSE operations of the Hercules Powder Co. at Hopewell, Va., consist of not only production of this product but in addition include manufacture of the several raw materials.

The shredded cellulose, either wood pulp or cotton linters, enters a covered horizontal trough where it is moistened by a spray of caustic. The wetted material is conveyed to the reactors, steam jacketed autoclaves, where it is acted on by ethyl chloride. When the processing cycle is completed, the ether and alcohol formed during ethylation are flashed off and recovered for use as raw materials for making ethyl chloride.

As the solvents are removed from the reactors ethyl cellulose precipitates in a liquor of caustic and brine. The slurry is blown to receiving tubs where the former is drained off. Ethyl cellulose granules are dropped into hammer mills in which they are ground. The cellulose is then washed free of caustic and purified. The water slurry is centrifuged and dried.

Recovered salt is dried and conveyed to a Laury type furnace and treated with sulphuric acid to form hydrochloric acid. The hot acid is removed by means of either a steam or electrically driven fan at the tail end of an absorption train. Salt cake spills out of the furnace and is cooled in a rotary water-jacketed cooler from which it is transferred to storage. After purification the hydrochloric acid is pumped to the ethyl chloride plant.

Raw materials for producing ethyl chloride are ether, alcohol and acid. The latter is vaporized and mixed with ether or alcohol (each system being separate) and together fed to reaction vessels under a few atmospheres of pressure where conversion to ethyl chloride takes place. The products, impure mixed solvents, are fed to still columns for separation of the ethyl chloride from unreacted components. The ethyl chloride is transferred to storage tanks for use in the ethyl cellulose reactors.

For a longer description of the production of ethyl cellulose and the raw materials consumed in its manufacture see pp. 129-136 of this issue.

CHEMICAL & METALLURGICAL ENGINEERING

September, 1945

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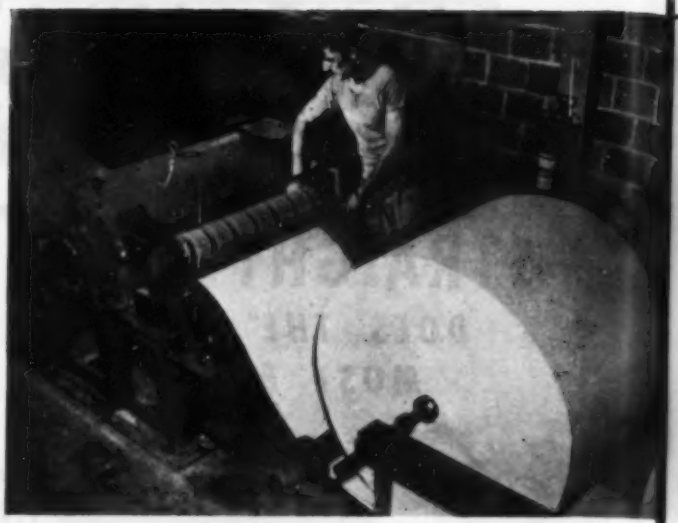
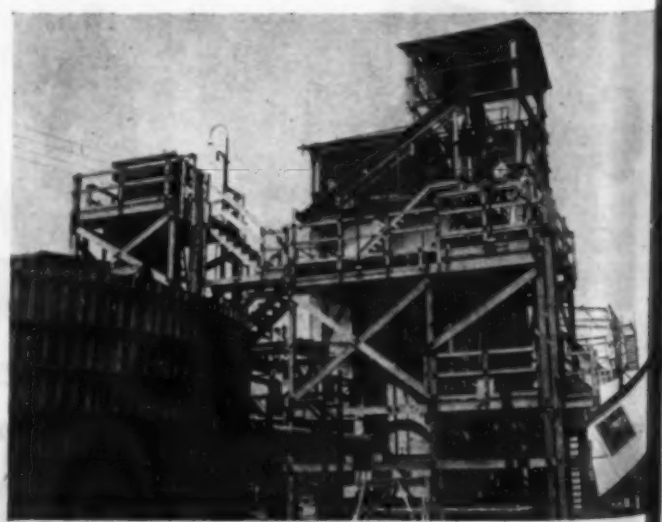
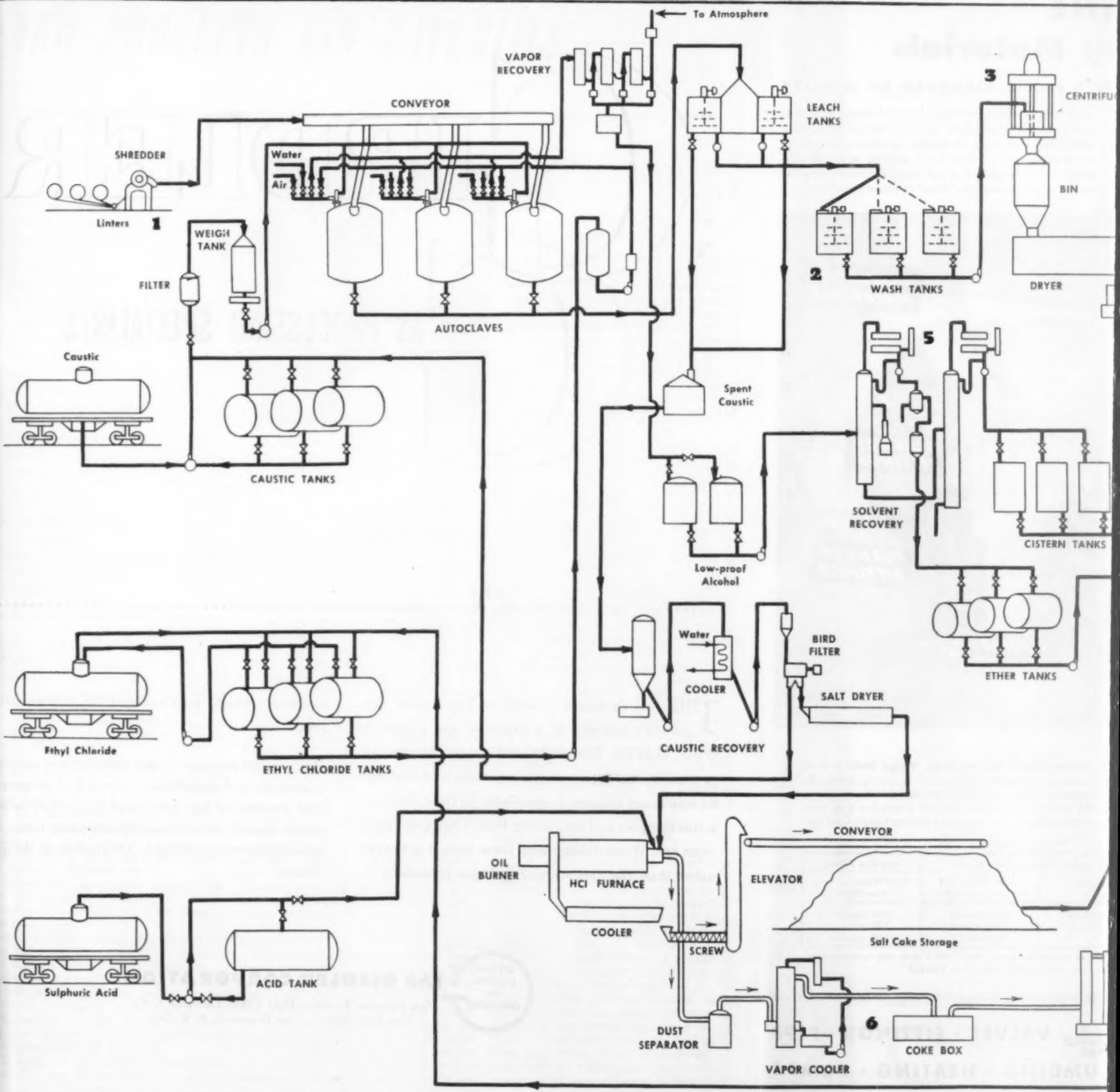


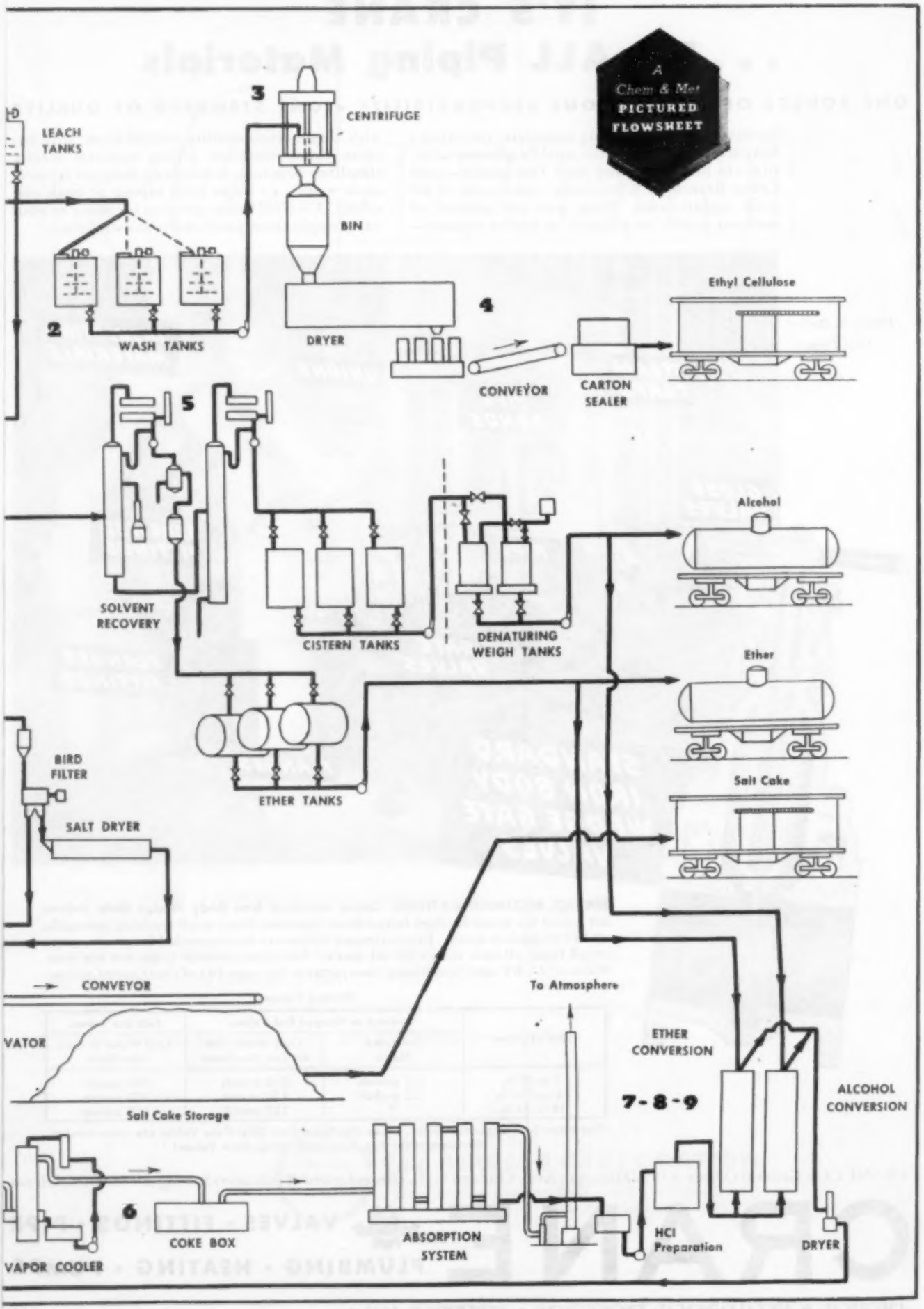
1 This Stern shredder reduces the linter sheet pulp to fibers which are blown to the reactor building nearby

2 Removal of all brine and caustic from ethyl cellulose granules is followed by a special purification treatment



6 HCl for use in the ethyl chloride unit is made from H_2SO_4 and salt. Coke-packed filter shown on left


To Atmosphere
VAPOR RECOVERY
CONVEYOR
LEACH TANKS
3
CENTRIFU
SHREDDER
Water
Air
BIN
Linters
1
WEIGH TANK
FILTER
2
WASH TANKS
DRYER
AUTOCLAVES
Caustic
5
Spent Caustic
CAUSTIC TANKS
SOLVENT RECOVERY
CISTERN TANKS
Low-proof Alcohol
ETHER TANKS
Water
BIRD FILTER
COOLER
SALT DRYER
Ethyl Chloride
CAUSTIC RECOVERY
ETHYL CHLORIDE TANKS
CONVEYOR
OIL BURNER
HCl FURNACE
ELEVATOR
COOLER
SCREW
Salt Cake Storage
Sulphuric Acid
ACID TANK
DUST SEPARATOR
6
COKE BOX
VAPOR COOLER


A
Chem & Met
PICTURED
FLOWSHEET
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SEALER
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SOLVENT
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CISTERN TANKS
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Ether
ETHER TANKS
BIRD
FILTER
SALT DRYER
Salt Cake
CONVEYOR
VATOR
Salt Cake Storage
To Atmosphere
ETHER
CONVERSION
7-8-9
ALCOHOL
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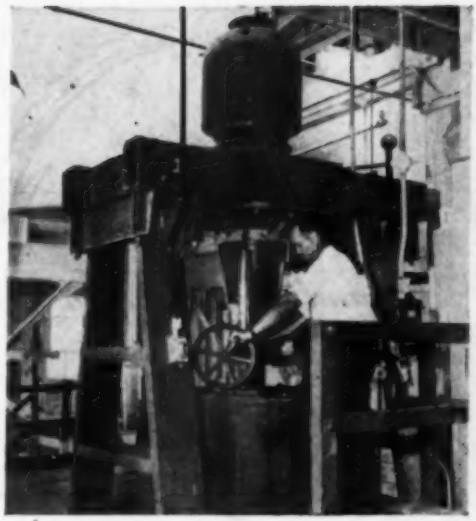
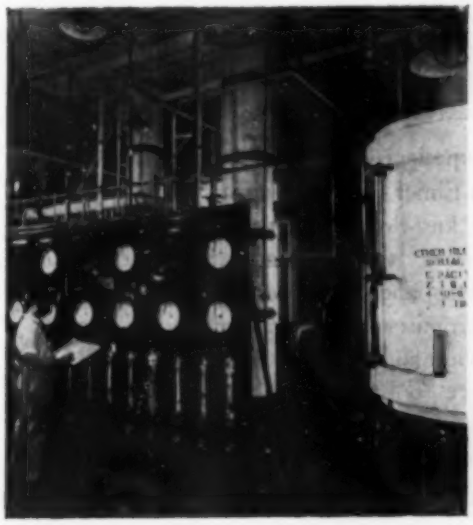
COKE BOX
ABSORPTION
SYSTEM
HCl
Preparation
DRYER
VAPOR COOLER

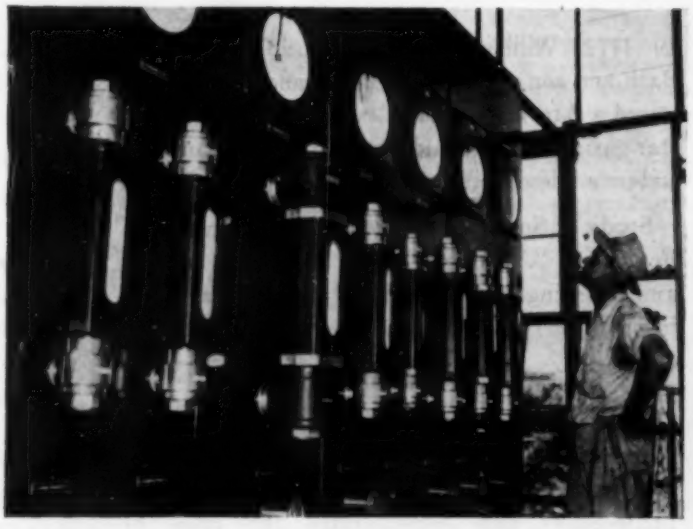


3 From feed tub above, ethyl cellulose is dewatered in centrifuge before drying

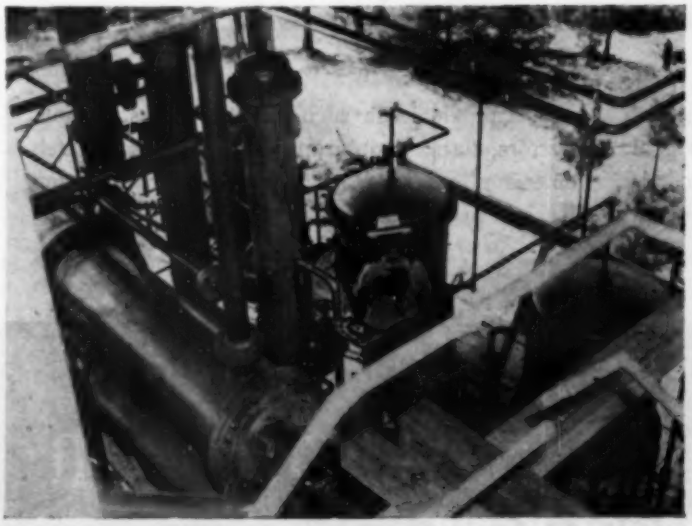
4 Packed in paper cartons ethyl cellulose is stacked in warehouse preparatory to shipment



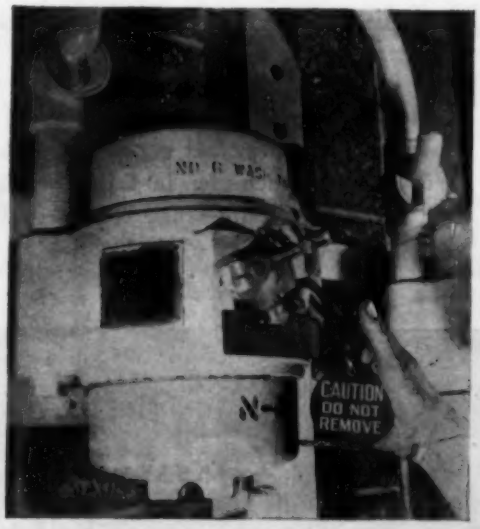
5 Ether and alcohol formed during ethylation are scrubbed and condensed



7 Control board in the solvent recovery system where ethyl chloride, ether, and alcohol are separated



8 Copper coolers, condensers, decanters, and lines fill operating floors of solved recovery building in ethyl chloride unit



9 In addition to explosion proof switch gear, safety snaps are used for protection

SIR WILLIAM HERSCHEL

He borrowed a TELESCOPE *and revolutionized* ASTRONOMY

IN 1772, William Herschel, music teacher of Bath and son of a Hanoverian bandmaster, borrowed a 2-ft. Gregorian telescope for some casual star-gazing. Fascinated by what he saw and unable to buy a telescope, he decided to make one.

Study of Smith's "Harmonies and Optics" and Ferguson's "Astronomy" and hard work casting and polishing specula resulted after several years in a 5-ft., a 7-ft. and even longer instruments.

HE DISCOVERED URANUS

Through his 7-ft. telescope, he discovered "Georgium Sidus" (Uranus) in 1781. Herschel carried figuring of his mirrors far beyond those of his predecessors and demonstrated the value of aperture to definition and grasp of light. Recognized as the link between the old and new astronomy, he won knighthood and the perpetuation of his name in the Herschelian "front view" telescope.

PURSUIT OF PERFECTION

Men of science like Herschel and his modern disciples have always set perfection as their goal. Working with such men in Industry, Education and the Armed Forces has been a challenge to Perkin-Elmer to supply them with the finest in optical instruments, lenses, prisms and other optical elements.

To the experience and skill that won recognition for Perkin-Elmer before the war has now been added the knowledge and experience gained in *mass-producing* its most accurate products for war industries and the armed forces. This combination promises much for the optical instruments, devices and elements which Perkin-Elmer will produce to bring even greater accuracy to analysis, control, inspection and observation in *postwar* applications.

WHAT PERKIN-ELMER MAKES

Perkin-Elmer serves the optical sciences that broaden man's horizons by supplying them with:

Custom-built optical instruments for industrial analysis, control, and inspection.

New optical devices to solve specific problems.

Special elements such as fine lenses, prisms, mirrors, flats, photographic objectives, interferometer plates, retardation plates, Cornu prisms, Rochon prisms, and Nicol prisms.

P E C

THE PERKIN-ELMER CORPORATION

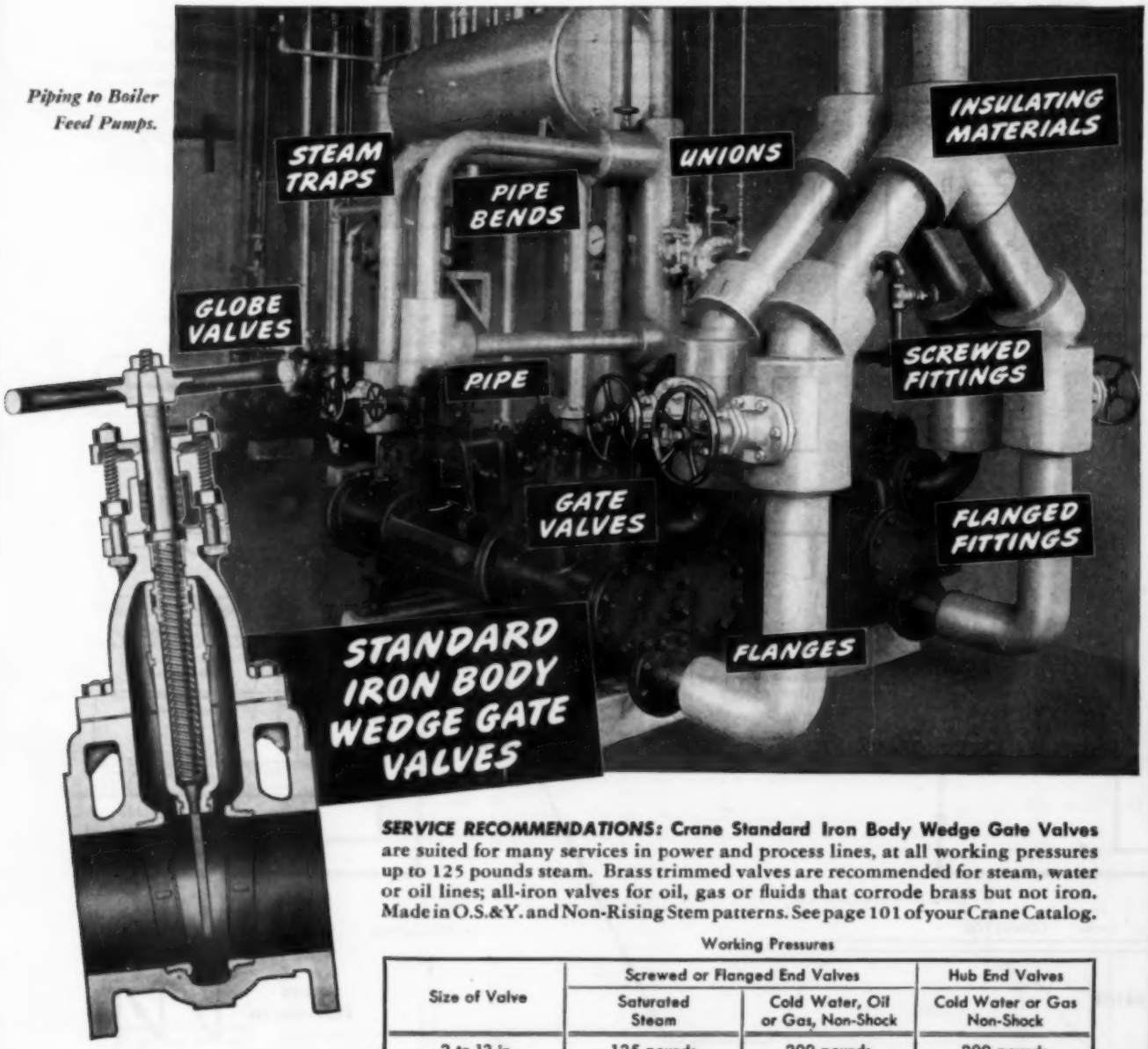
GLENBROOK · CONN ·

IT'S CRANE
. . . For ALL Piping Materials

ONE SOURCE OF SUPPLY • ONE RESPONSIBILITY • ONE STANDARD OF QUALITY

By choosing Crane piping materials, you always have the advantage of the world's greatest selection—in brass, iron and steel. One source—your Crane Branch or Wholesaler—takes care of all your requirements. Thus, you are assured of uniform quality in all parts of piping systems—with single responsibility behind them. And because Crane complete piping material service simplifies ordering, it speeds up deferred replacement work . . . helps keep piping at peak efficiency. A typical Crane solution for many of your valve application problems is shown below.

Piping to Boiler Feed Pumps.



SERVICE RECOMMENDATIONS: **Crane Standard Iron Body Wedge Gate Valves** are suited for many services in power and process lines, at all working pressures up to 125 pounds steam. Brass trimmed valves are recommended for steam, water or oil lines; all-iron valves for oil, gas or fluids that corrode brass but not iron. Made in O.S.&Y. and Non-Rising Stem patterns. See page 101 of your Crane Catalog.

Working Pressures

Size of Valve	Screwed or Flanged End Valves		Hub End Valves
	Saturated Steam	Cold Water, Oil or Gas, Non-Shock	Cold Water or Gas Non-Shock
2 to 12 in.	125 pounds	200 pounds	200 pounds
14 and 16 in.	125 pounds	150 pounds	150 pounds
18 to 24 in.	*	150 pounds	150 pounds

*For steam lines larger than 16-in., Crane 150-Pound Cast Steel Gate Valves are recommended. (For sizes under 2-in., use Crane Clamp Gate Valves.)

CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill. • *Branches and Wholesalers Serving All Industrial Areas*

CRANE VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

GIRDLER

GAS PROCESSING SPECIALISTS

THE Gas Processes Division of The Girdler Corporation consists of a group of gas processing SPECIALISTS. Under the ideal conditions provided by Girdler, highly developed scientific and engineering minds are enabled to go all-out in their attention to this complex and interesting field. They don't guess about gas. When dealing with these men, it is the rule rather than the exception to get gas processing installations which operate efficiently, economically and profitably.

Girdler offers processes for gas manufacture, purification, separation, and dehydration. Consult us on your problems concerning hydrogen sulphide, carbon monoxide, carbon dioxide, natural gas, refinery-gases, liquid hydrocarbons, hydrogen, nitrogen. Originators of the Girbotol process.

CHEMICAL ENGINEERS AND CONSTRUCTORS

The GIRDLER CORPORATION

Gas Processes Division, Dept. CM-9, Louisville 1, Ky.
New York Office . . . 150 Broadway, N. Y. City

NEW PRODUCTS AND MATERIALS

JAMES A. LEE, Managing Editor

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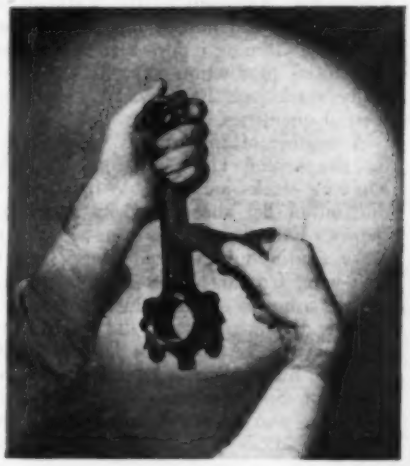
REMOVABLE PROTECTIVE COATING

INFORMATION has been made available concerning a peelable plastic film known as Liquid Envelope, developed during the war and used to coat thousands of warplanes before overseas shipment as deck-load. The product is a formulation of vinyl resins, plasticizers and adhesives dispersed in a volatile vehicle. In its wartime use, this was sprayed over the entire plane from nose to tail and wing-tip to wing-tip. In a few minutes it dried to a tough impervious elastic film which protected the plane while aboard ship, but which could easily be peeled off in big rubbery sheets at the point of destination.

Among the foreseeable postwar uses are the protective packaging of sundry machine parts during transit and storage, the preservation of laid-up machines and motors, and the packing of so-called hard goods like refrigerators, plumbing fixtures, and fine furniture. Liquid Envelope is said to have no harmful effect of any kind on the underlying surface, and it can be produced to meet a wide range of requirements as to color, transparency, drying rate, adhesion, elasticity, method of application, and film thickness.

It melts at an indefinite temperature above 250 deg. F. and, depending on the formulation, becomes tacky at 180 deg. F. or above. Formulations designed to remain flexible at no lower than 0 deg. F. are non-flammable, and all formulations show good resistance to gasoline, oils, fats, acids, alkalis, alcohol and salt spray. Vapor transmission is within the range, 0.25 to 3.0 gm. per 100 sq. ft. per 24 hr. According to the manufacturer, Better Finishes and Coatings, Inc., Newark, N. J., the cost of Liquid Envelope is comparable with any good synthetic resin coating, and its apparent durability suggests 25-yr. protection of goods in storage.



Rubbery protective coating, Liquid Envelope, is stripped from a connecting rod after shipment and storage

FURANE ADHESIVES

ANNOUNCEMENT has been made by Furane Plastics and Chemicals Co., Los Angeles, Calif., that in their two new adhesives, Resins X and X-1, they have achieved the first commercial development of polymers based solely on furane chemicals. As furane derivatives, the adhesives possess a number of distinctive characteristics, most outstanding of which are their complete resistance to boiling water, their ability to cure at room temperature under little or no contact pressure, and their high bond shear strengths. They have been found especially suited to the bonding of rubber, wood, and most plastics.

Both adhesives—X is all liquid resin and X-1 is a solvent type—develop bond strengths greater than shear strengths of laminated phenolics, ureas, acrylics, woods, rubbers, Masonite and others. Full strength is developed by curing for several days at 80-85 deg. F. or overnight at 120 deg. F. Several hours is usually sufficient time in jigs. Shelf life of the adhesives is at least a year; after the required 3 percent of catalyst is added, the pot life at room temperature is 15 min. in the case of Resin X and 3-4 hr. in the case of X-1.

LIQUID CASTING RESIN

FIRST postwar product to be announced by the B. F. Goodrich Co. is a thermosetting, non-flammable anhydrous liquid resin called Kriston, which may be cast in simple molds to form plastic articles whose outstanding characteristics are chemical and abrasion resistance, optical and electrical properties. Kriston is a somewhat viscous, water-clear monomer which, in the presence of a suitable catalyst, polymerizes at low temperature and no pressure. In its liquid state, Kriston is a relatively high molecular weight allyl ester resin containing chlorine.

In the cast and polymerized state, Kriston is odorless, tasteless, nontoxic, dimensionally stable, and adaptable to standard machining and polishing procedure. It can be made in any color or degree of transparency, including water-clear. Its refractive index (about 1.57) is higher than most optical glass. Other properties are high dielectric strength and electrical resistivity; abrasion resistance much higher than the thermoplastics; high resistance to oils, greases, acids and alkalis. The fact that no volatile products are released during polymerization favors production of dense, nonporous articles. Mold shrinkage is unusually low.

Applications which seem to hold most promise for cast Kriston plastics are in the optical industry for lenses, prisms and transparent sheets; the electrical industry for insulators, control knobs and panels; the chemical industry for corrosion resistant parts of valves, pumps and agitators; the laminating field for low-pressure laminates of wood, paper and fabric; and finally, the fields of fashion and decoration for applications where eye appeal and utility must be combined.

MENTHYLPHENOL

THIS terpene hydrocarbon derivative is now offered in commercial quantities by Hercules Powder Co. as an efficient stabilizer for ethyl cellulose and as an economical plasticizer extender for cellulose acetate. Known as Stabilizer X during its laboratory development days, the material is now marketed as Menthylphenol, a crystalline solid with a slight yellow color and a melting range of 140 to 176 deg. F.

As a stabilizer with ethyl cellulose, menthylphenol has been found effective in preventing that viscosity degradation which results in embrittlement. At the same time, any color change in moldings is minimized; in this respect the stabilizer appears to be outstanding as compared to

other stabilizers so far used with ethyl cellulose. It also imparts to ethyl cellulose some additional stability against outdoor weathering. The optimum amount of menthylphenol to use with ethyl cellulose is between 1 and 3 percent of the total solids in the mix.

As a plasticizer extender with cellulose acetate, menthylphenol may be used satisfactorily (1) when the plasticizer to be extended is triacetin, dimethyl phthalate, or diethyl phthalate and (2) when the addition of menthylphenol is not more than one-third of the plasticizer being extended.

RUST INHIBITORS

Two NEW types of specialized rust inhibitor have been developed by Carbozite Corp., Pittsburgh, Pa., manufacturer of industrial coatings. Carbo-C Inhibitor and Carbo-N Inhibitor are slated for temporary rust prevention of metal surfaces during inside storage; they are not impervious to rain or snow and are not suggested for rust prevention during outside storage.

Carbo-C, the more versatile of the two, is inactive toward all metals and alloys, including magnesium and aluminum. Carbo-N has no effect on ferrous alloys, but does have a light action on softer metals such as lead, zinc, magnesium and aluminum.

It is said that the inhibitors have also been used successfully in preventing rust in pipe systems which drain salt solutions from crude oil storage tanks and from the bottoms of tanks where water and brine solutions are used in the manufacture of ice. They are also useful in mixture with cutting oils to protect threads from rust. Distribution of Carbo-C and Carbo-N is made in concentrated form, to be diluted for use with 25-100 parts of water.

SILICONE RUBBER

A NUMBER of silicone rubber stocks for molding, extruding, coating, and laminating are now available from the Dow Corning Corp., Midland, Mich., under the brand name, Silastic. While these rubbery organo-silicon oxide polymers have been under development for a considerable period of time and have been produced in limited quantities for war uses, they have not been made generally available in commercial amounts until very recently.

The outstanding characteristic of silicone rubber is its ability to remain rubbery at temperatures which organic rubbers, either natural or synthetic, are ordinarily unable to withstand. Thanks to its largely inorganic origin, it remains elastic and compressible at temperatures up to 150 deg. C. for long periods of time and up to 200 deg. C. for certain applications; it also retains flexibility down to temperatures as low as —57 deg. C.

Other properties, in addition to the primary attribute of heat resistance, may be of interest in considering particular applications. Silastic has excellent chemical and oxidation resistance, is waterproof, and is resistant to salt brine and oil at high temperatures. It has good electrical properties, notably, arc resistance, non-tracking, dielectric constant at one million cycles of 5.0 to 7.5, power factor at one million cycles of 0.13 to 0.18 percent, and dielectric strength of 500 volts per mil. Tensile strength ranges from 200-330 psi. and elongation varies from 70-115 percent. It adheres strongly to glass, vitreous enamel, iron, steel, and aluminum.

These properties hold generally for the whole series of Silastics, which are furnished compounded and ready for molding, extruding or coating in several stocks covering a range of physical properties and hardnesses. Although Silastic is still under development and improvement is continuous, Dow Corning reports that it now has substantial production capacity and that many stocks are now available in commercial quantities.

A number of applications are suggested for the several kinds of stock available. Molding stocks are available for the production of flat sheets, gaskets and other shapes. Extruding stocks can be used to make continuous extruded shapes and to coat wire. Coating stocks are available for coating asbestos or glass cloth from which gaskets, diaphragms, tape, and electrical insulation may be obtained; laminates may be made by curing under pressure multiple layers of Silastic-coated inorganic fabric; Silastic is also adaptable to the protective coating field.

IMPROVED POLYSTYRENE

THE QUALITY of The Dow Chemical Co.'s polystyrene plastic molding compound has undergone vast improvement during recent months with no attendant increase in price, according to a recent statement by that company. The former product, Styron K-27, was officially replaced by the improved material, Styron 411, on September 1.

Easier mold release, improved surfaces, superior welds, better flow control, and elimination of the need for external lubrication are the advantages set forth. Among mechanical improvements claimed for Styron 411 are increased weld strength and better machinability. Buffing operations are more easily performed. In trimming, the new material shows reduction in tendency to tear back. Welds are scarcely perceptible and the reduction of surface marks in 411 enhances appearance and gloss.

COLD SETTING ADHESIVE

A RESORCINOL adhesive which sets at room temperature but "develops the joint strength, durability, and moisture resistance usually associated only with hot-press phenolics" has been announced by Resinous Products & Chemical Co. of Philadelphia. Known as Amberlite PR-115, the resin was developed originally for bonding wood to wood, but it has subsequently demonstrated that it also has good adhesion on laminates, rubber, and transparent plastics. It is now recommended for its good adhesion to relatively impervious surfaces, speed of cure, durability, and good gap filling qualities.

Amberlite PR-115 resin is supplied in solution and requires the use of Catalyst P-117, a dry, tan-colored powder, to effect cure. The prepared glue mix has a pot life of about 3½ hr. at 77 deg. F., with a permissible open assembly time of 30 min. or a closed assembly period of 45 min. Pressure in laminating should be sufficient to produce a thin glue line and, depending upon the density of the wood, will be in the range of 100 to 250 psi. The ability of the adhesive to cure at moderate temperatures plus its fast cure at elevated temperatures has made it especially well suited to radio frequency gluing equipment.

RESINOUS CEMENT

DESIGNED specifically for bonding corrosion-proof brick and tile in uses where both acid and alkali are encountered, a new resin-type cement, known as Pennsalt PRF Cement, has recently been developed by the Pennsylvania Salt Manufacturing Co., Philadelphia, Pa. It is quick setting and cold hardening and is composed of a liquid and a powder which react chemically when mixed.

Typical applications are the laying of floors and drains and the lining of tanks in electroplating shops where a cement is required that will resist corrosive acids, alkalis, and solvents.

UPHOLSTERY FABRIC

A FIRE-RESISTANT, plastic-coated upholstery fabric developed for aircraft, tanks and ships is expected to find wide postwar use in boats, theaters, restaurants and office furniture. Product of the Du Pont Co., the fabric is known as P. C. Cavalon and consists of a flameproofed cotton cloth base, coated on one side with a pliable fire resistant synthetic resin. It handles and feels like soft leather.

The material will char in contact with a flame but will not support combustion. It does not crack at temperatures as low as —30 deg. F. In a few months a wide range of colors, grains and finishes will be available.

AGRICULTURAL DDT

THE NAME to be given by the DuPont company to its agricultural insecticide containing DDT has recently been announced as Deenate. Compounds containing the powerful pesticide will be ready for fruit and vegetable growers as soon as reduction of military demands permits.

In pure form DDT is not an efficient insecticide, but must be combined with proper carriers for the particular job at hand. Therefore, the Deenate compositions that have been evolved for agriculture are specialized formulations for specific pest control problems.

LAMINATING ADHESIVE

PRODUCTION of strong, durable laminations of metals, plastics, and woods in various combinations is the stated purpose of a new adhesive, Cordo-Bond No. 250, produced by Cordo Chemical Co., Norwalk, Conn. It is being promoted as a general purpose adhesive for mass production of light weight, high strength constructions such as table tops, aircraft equipment, shipping cases, and trailer and bus bodies.

The adhesive is normally cured by baking at a glue line temperature of 250 deg. F. under pressure of 50 psi. for periods up to 15 min. Bond shear strengths up to 2,000 psi. are obtained; bonds are moderately flexible, non-brittle, and show good

. . . Of interest to users of Santobane* (Monsanto's Dichloro-Diphenyl-Trichloroethane, Tech.), and to users of formulations of this famous war-developed insecticide, is this announcement of a joint research development . . . in the laboratory and in the field . . . by Monsanto Chemical Company and McLaughlin-Gormley-King Co. whereby the latter will be able to offer to its many licensees dependable formulations of Santobane for pest control.

This first announcement of such a combined operation does not mean that consumers can immediately expect Santobane formulations to end insecticide problems in industry, on the farm or in the home. Santobane is still going practically 100% to the military, with only experimental quantities available for other use. Also, there is considerably more to be learned about Santobane's proper formulation as well as its toxicity to humans before its full effectiveness or its limitations can be determined.

But the program as announced here has been set up, excellent results have been achieved, and the millions interested in positive pest control can look forward with confidence to the same excellent results from Santobane's peacetime applications as are being achieved in war. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second St., St. Louis 4, Missouri. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Seattle, Montreal, Toronto.

MONSANTO CHEMICALS
SERVING INDUSTRY . . . WHICH SERVES MANKIND

*Reg. U. S. Pat. Off.

BROKEN OVERHEAD GASOLINE LINE FIRE KNOCKED OUT IN SIXTY-FIVE SECONDS

NEW DUAL-STREAM NOZZLE

Further increases fire-fighting effectiveness of

DUGAS EXTINGUISHERS

Pictured above is a rigorous test conducted at the DUGAS Division Test Grounds, under observation of Underwriters' Laboratories and Factory Mutual Laboratories. Burning gasoline escaped at the rate of 10 gallons per minute under 50-lb. pressure through three hacksaw cuts in a pipe 13 feet above ground.

Inset shows how quickly the fire was knocked out by DUGAS Dry Chemical after it had been allowed to burn for one full minute. Using the straight stream from the new dual-stream nozzle on a No. 350-A DUGAS Wheeled Extinguisher, the overhead gasoline fire, including blaze on ground, was extinguished in exactly 65 seconds.

NEW DUAL-STREAM NOZZLE...

deals effectively with spill fires and fires difficult to reach because of height or obstructions. Designed for use with DUGAS Wheeled Extinguishers, the new dual-stream nozzle greatly increases fire-fighting range and effectiveness. A turn of the handle gives a straight stream with a range of 45 feet—or a fan stream with a range of 15 feet.

Quick Facts About DUGAS Dry Chemical

1—For extra-hazardous fires involving flammable gases, liquids, greases or electrical equipment.
2—Not an electrical conductor.
3—Non-toxic, non-corrosive, non-abrasive.
4—Not affected by extreme cold or heat.

Write today for complete information regarding DUGAS Wheeled Extinguishers with the New Dual-Stream Nozzle... and DUGAS Hand Extinguishers.

AN ANSUL PRODUCT
duGas
THE MASTER OF FLAME

Approved by Underwriters' Laboratories, and Factory Mutual Laboratories.

ANSUL CHEMICAL COMPANY, MARINETTE, WISCONSIN
DUGAS DIVISION

impact resistance. Good resistance is shown to water, mild acids and alkalis, oil, salt spray, and general weather conditions. Maximum service temperature under continuous load is 250 deg. F., plasticity developing near 400 deg. F.

Cordo-Bond No. 250 comes dispersed in a solvent and requires no catalyst. It has a shelf life of about six months, is battleship gray in color, may be applied by brush, spray or roller-coating, and is said to be suitable for bonding all common materials (metals, plastics, wood, glass) with the exception of vinyl plastics and rubber.

HIGH STRENGTH ADHESIVES

A FAMILY of adhesives, known as the Metlbonds, has been made commercially available by National Research and Manufacturing Co., National City, Calif. It is claimed that the Metlbonds excel other high strength adhesives in one or more of the following respects: (1) Shear strength of 4,300 to 4,500 psi. can be obtained consistently. (2) Curing pressures of only 25 psi. are necessary. (3) A considerable portion of their strength is retained at high temperatures. (4) They do not become brittle at temperatures of —70 deg. F.

The Metlbonds were developed by Consolidated Vultee Aircraft Corp. at San Diego, work commencing in the latter part of 1942. Improvements and new types are being investigated continuously, and among the several members of the family can be found at least one type capable of bonding any given combination of glass, plastics, rubber, metal or wood. Some types are suitable for electrical applications and others for flexible coatings.

The first commercial work was conducted by Consolidated Vultee during the latter part of 1943 when Metlbonds were used to bond metal reinforcing plates to Toolite tooling fixtures. At about the same time a considerable number of Metl bonded sub-assemblies were installed in Consolidated-Vultee experimental aircraft; these parts are still in service and have flown over 1,500 hr. At the present time Metlbonds are being used for several important assemblies in Consolidated-Vultee production aircraft.

In one very large experimental bomber the leading edge of the wing is Metl bonded. The resultant contour of the section is so smooth that an estimated 15 m.p.h. is added to the plane's speed. This leading edge, while not in production at the moment, is a good example of a possible commercial application.

SEALING ADHESIVES

DESCRIBED as "a mineral, rubber-like adhesive," Carbozite Waterproof Paper Sealer is now available from the Carbozite Corp. of Pittsburgh for a variety of applications, some of which are as follows: Lamination of paper, adhesive for paper on wood or metal surfaces, heat-sealing adhesive for kraft wrappers, sealers for lumber to prevent warping and cracking, hot-dip build-up coating. It can be used in conjunction with waterproof paper in sealing the closures and joints of wooden boxes, as an adhesive for gluing waterproof

Winner of History's Greatest Race...

Since 1941, America has raced against Time—and won. During all the months of war, the General American Tank Car Fleet has been in action . . . transporting a hundred different vital liquids safely, surely—and economically.

To carry your postwar products, General American will design and build tank cars with every protective feature you need. They will help you win another great race—the future race against competition.

GATX GENERAL AMERICAN

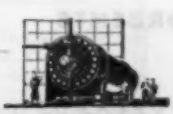
GENERAL AMERICAN TRANSPORTATION

CORPORATION

CHICAGO

Builders and Operators of Specialized Railroad Freight Cars

Bulk Liquid Storage Terminals


Process Equipment of All Kinds

Pressure Vessels and Other Welded Equipment

Aerocoach Motor Coaches

Precooling Service for Fruits and Vegetables

10 gallons of Motor Oil

and one quart of gasoline, please!

Year by year, as automobiles grow older, more and more motor oil and lubricants are required to keep them rolling.

Before automobile manufacture was suspended for the duration, some three million new automobiles were each year replacing the older "oil-burning" cars that had outlived their economic usefulness.

Today, these old automobiles are serving the transportation needs of the American public—and will continue to do so for years to come as it will require many years at maximum manufacturing capacity to produce enough new automobiles to catch up with the years of non-production plus the normal annual obsolescence.

It is important for every lube oil refiner to consider now, whether his present methods are producing the volume and quality, to retain and develop the growing needs for more and better motor oil.

Filtrol Fractionation and Contact Filtration Units are not only delivering postwar quality today — but are doing it at minimum labor — minimum cost—highest quality—in great volume.

FILTROL CORPORATION

General Offices: 634 South Spring Street, Los Angeles 14
Plants: Vernon, California; and Jackson, Mississippi

Filtrol* CATALYSTS AND ADSORBENTS

PRODUCTS OF FILTROL RESEARCH AND DEVELOPMENT

*Reg. U.S. Pat. Off.

paper liners to wood boxes, or for sealing carton flaps and waterproof paper bags.

As to its characteristics, the adhesive is said to be impervious to water and not affected by fungi. Application may be hot or cold—by brush, spray or dip method. It dries fast and forms a smooth coat with no lumps.

FIRE RETARDANT COATING

A PAINT-LIKE material designed to protect wood and other combustibles against intense sustained fire was recently put on the market by the General Detroit Co., Detroit 7, under the name Firepel-S. Test and approval by Underwriters' Laboratories, Inc., is cited by the company as evidence of its ability to reduce fire hazards by preventing "flash" fires and by retarding flamespread. It is emphasized that Firpel-S differs from fire retardant paint in that it is in itself a fire retardant compound—it won't burn and it protects the material to which it is applied—while the fire retardant paints are ordinary paint formulations which, though loaded with a filler that won't support combustion, give practically no protection to the material underneath.

Firepel-S is applied with brush or spray gun about like heavy enamel and dries bone-white in color, though tints and colors can be added easily if desired. It is important to note that the product is for interior use only and should not be used where exposed to rain, hot water, sustained high humidity, or sudden changes in temperature. The coating adheres well to wood, fiber-board, and like materials and may be applied over old flat paint surfaces but not over gloss paint, enamel, varnish or waxed surfaces. Recommended practice calls for two coats preceded by a sizing wash of zinc sulphate solution. One gallon, after dilution with one quart water, provides two coats for about 125-185 sq.ft. of wood.

DURABLE RUBBER HOSE

A SYNTHETIC rubber hose developed by the U. S. Rubber Co. for use in aircraft cooling and lubrication systems boasts increased resistance to both heat and pressure. The improved hose is designed to withstand temperatures up to 250 deg. F. in oil lines and up to 300 deg. F. in cooling systems. Resistance to pressure in 1-in.-dia. hose is double that of hose formerly used, with corresponding increases in the other sizes, which range from ¼ to 2½ in. in diameter. Credits for the improvements go to a special heat resistant synthetic rubber and to a new high strength carcass built with Ustex, a chemically treated cotton yarn much stronger than regular untreated yarn.

GUM BENZOIN

COMMERCIAL production of synthetic gum benzoin has reached a point where the product compares favorably in purity and cost with the natural type from Siam, according to McKesson & Robbins, Inc., distributor of the product for the Bendix Chemical Corp. This preparation, now being manufactured in Long Island City and Philadelphia, is used to fix the odor of incense, skin soaps, perfumes and other cosmetics. It is also employed as a fixer for

Here's the MULTICLONE Story in a Nutshell . . .

IT SAVES SPACE

and we mean really important space savings. The chart here tells only part of the story because, in addition to being far more compact both in square and cubic footage, the *shape* of the MULTICLONE can be adjusted to fit various space requirements—long and narrow, short and wide, or square. You can often fit the MULTICLONE into tight spaces or waste areas too small for other equipment!

Make	Relative Space Requirements In Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.8
Collector B	5.9	3.2
Collector C	6.8	3.9

IT RECOVERS THE "FINES"

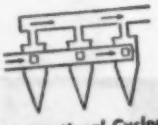
as well as the coarser particles. Its patented *vane* design and small diameter tubes generate higher centrifugal forces, thus recovering a large percentage of the very fine particles 10 microns and less in addition to the heavier particles. MULTICLONE's high recovery of *both* small and large particles means high overall efficiency on *any* application!

IT IS UNUSUALLY ADAPTABLE

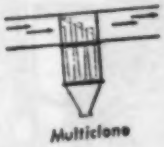
for, in addition to the *shape* adaptability outlined above, inlet-outlet connections are also easily adaptable. For low headroom, install the MULTICLONE with side-inlet, side-outlet. Or for tight side clearances, use side-inlet, top-outlet connections. Still other arrangements are possible for special conditions!

IT IS SIMPLE

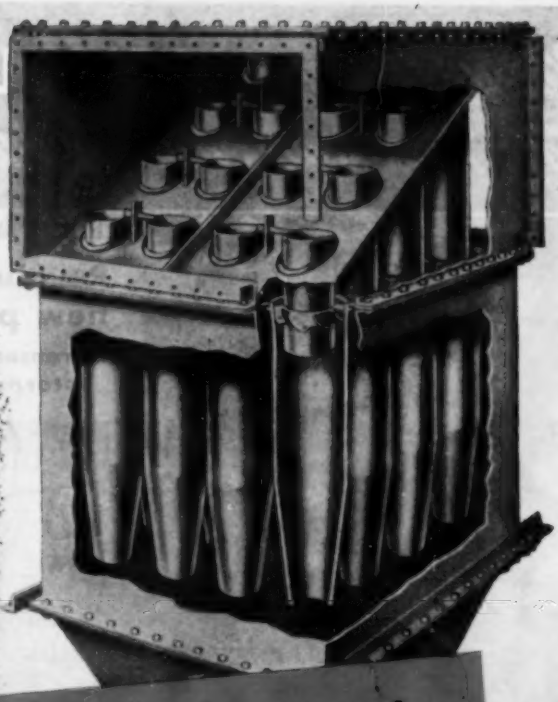
both to install and to maintain. For example, the MULTICLONE requires only single inlet and outlet ducts compared with the complicated *multiple* ducts of conventional cyclones. Not only saves space—but is simpler and cheaper to install and insulate. Moreover, the MULTICLONE has no filters to clog, no high-speed moving parts to maintain . . . and a single collecting hopper serves an entire bank of tubes!



Conventional Cyclone



Multiclone



On *any* dust recovery job —large or small— the MULTICLONE has *many* advantages!

WHY LIMIT your dust recovery job to one or two performance features when the Multiclone combines so *many* important advantages in the one unit? Check over some of the Multiclone's multiple savings outlined at the left. Note how—on every important feature the Multiclone is the answer.

These and other Multiclone advantages are the result of experience gained through more than 38 years of specialization in the science of dust recovery, beginning with the first commercial application of the well-known Cottrell Electrical Precipitator. Take advantage of these years of specialized study by installing Multiclone.

GET ALL THE FACTS. Send for this booklet that describes the many MULTICLONE advantages. Also let our trained engineering staff study your particular problem and show how MULTICLONE's multiple savings will benefit you. No obligation, of course.

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

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COTTRELL PRECIPITATORS · MULTICLONE COLLECTORS · TURBULAIRE SPRAY DRYERS

New Baker ARTICULATED Fork Truck cuts aisle requirements

DESIGNED PRIMARILY FOR EFFICIENT WAREHOUSE OPERATION

A basically new design* involving a new method of steering by "articulating" the frame, permits swinging the load to line it up in position without lining up the truck itself. Thus this truck requires about two feet less space for placing loads at right angles to aisles. It needs less clearance on turns, and speeds carloading or any other handling operation where loads must be lined up or positioned in congested areas.

Specific advantages of this truck are:

1. Works in narrower aisles.
2. Turns in a smaller radius.
3. Spots loads quicker and easier.
4. Control units are more accessible.
5. Simpler Steering design cuts maintenance.
6. Permits mechanization of handling where hand trucks were necessary because of space limitations.

Field tests in both warehouse and production operation have proved the many advantages of this new truck. For complete specifications request Bulletin 1330.

*Licensed under Stevenson Patent No. 2,284,257.

BAKER INDUSTRIAL TRUCK DIVISION *of The Baker-Raulang Company*
2145 West 25th Street • Cleveland, Ohio
In Canada: Railway and Power Engineering Corporation, Ltd.

the tastes of certain pharmaceutical products. The best grade is said to analyze at 100 percent chemical purity as compared to 95 percent for the natural Siam type.

TIRE PAINT

MANY uses for their new black tire paint have been outlined by the B. F. Goodrich Co. of Akron. These include application to tires after repairs or recapping to restore original "factory finish" and after washing or waxing. Floor boards and running board matting are also improved in appearance and are said to be given longer life by the application of the paint.

The product is marketed in concentrated form and can be obtained in 1 or 5-gal. cans. One gallon of the concentrate, when mixed with gasoline, produces up to 9 gal. of paint.

ANTI-FOG PREPARATION

GOGGLE lenses, face shields, and welding plates won't get foggy or "steamed-up," according to the American Optical Co., Southbridge, Mass., if the lenses are treated with their new AO anti-fog material. The preparation is said to penetrate the pores of glass and to deposit a thin film which helps prevent fogging, steaming, and frosting on all types of glass surfaces. In addition to removing the fog annoyance, its application takes off grease and dirt as well. The product comes in 1-oz. or 1-lb. jars, and is applied by spreading on both surfaces of the glass, rubbing the surfaces thoroughly, then polishing with soft cloth or paper.

CEMENT DUSTPROOFER

A LIQUID designed to stop troublesome dusting of cement floors is now available from Synthex Products Co., New York. Known as Synkrete, the liquid concentrate is diluted with three parts water before use, then applied by brush, mop, or sprinkler to saturate an area. It penetrates and fills the pores, reacts with the cement, and becomes hard and tough. Report has it that not only is dusting eliminated, but the treated floor is more resistant to traffic and to the effects of moisture and chemicals.

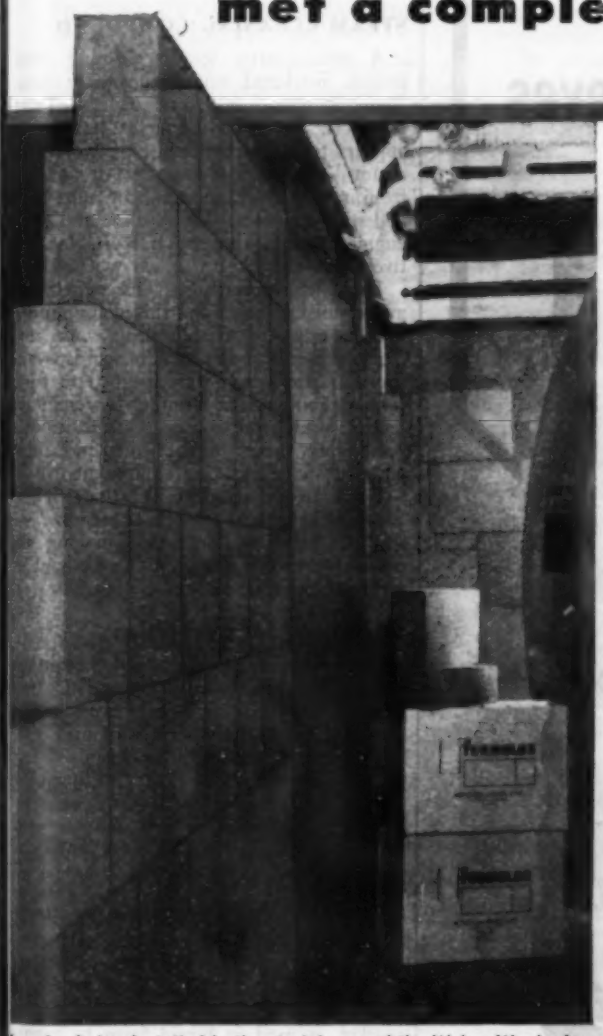
Drying requires but a few minutes, so that floors remain usable though the reaction is not complete for several days. One gallon of concentarte covers 800-1,800 sq.ft. per application, and while one application is sufficient to allay dusting, two or three are recommended for lasting results. The present period of reconversion, when equipment is being changed and shifted, is suggested as an opportune time to treat offending floors without undue labor or interruption to production.

RUST INHIBITOR

A NEW development in rust inhibiting treatments for metal parts is seen in the product Micronoil Riso, an acid-free soluble oil produced by Protective Coatings, Inc., Detroit 27. One part oil is added to 15 to 50 parts water, depending upon the nature of the parts to be treated. It is used at a temperature of 160 deg. F., and the parts are immersed in the bath until they come to heat, then drained.

The Riso treatment is said to be particularly effective in preserving black-oxide

How this extra strong insulation met a complex moisture problem



Foamglas being installed in the stock house of the Weber-Waukesha Brewing Co., Waukesha, Wisc.

Physical Properties of Foamglas*

Specific Gravity....0.17 (10 to 11 lbs./cu. ft.)
K (conductivity at 50° F.)..... 0.40 Btu/hr./sq. ft./°F./in.
Coefficient of Expansion (°F.).....0000046
Specific Heat...16 to .19 Btu/lb./°F.
Crushing Strength..150 lbs./sq. in.
Modulus of Rupture..90 lbs./sq. in.
Impact Strength (center drop-increment method on 8" x 16" x 5" thick specimens supported on a 12" span).....66 ft.-lbs.
Absorption (24-hr. immersion in water) 0.4% by volume—2% by weight (all at surfaces)
Air Infiltration or Permeability...0
Capillarity.....0
Volume Change with Moisture...0
(Data supplied by Pittsburgh Corning Corp.)

INSULATING a refrigerated high humidity room in a cold climate presents special difficulties in controlling moisture and frost. Armstrong's engineers solved this problem, in one instance, with an unusual construction.

Inside a brewery stock house in Wisconsin, temperatures were moderate but humidity was high, while outside winter temperatures often went well below zero. If moisture got into small crevices between the building wall and the insulation, and froze there, the insulation would be damaged. This particular outside wall was very rough and backplastering was impractical. If insulation were set directly against this wall, small air spaces would be left which might cause trouble.

Armstrong's Contract Service overcame these difficulties with Foamglas* insulation. This exceptionally strong and rigid material was erected as an independent wall, 3 stories high, set a minimum of one inch away from the building wall. The space between the two walls is provided with special drains so that moisture and frost cannot collect. Also since Foamglas is a positive vapor-barrier, moisture from indoors cannot get into this space through the insulation.

Foamglas insulation offers other advantages. It cannot sag, shrink, swell, or decay. And because it is made of tiny glass-walled sealed cells, Foamglas is also vermin-proof and fireproof. It provides lasting insulation efficiency.

For many refrigerated processes operating under unusually exacting conditions, these special qualities of Foamglas can be utilized. For full information, write today to Armstrong Cork Co., Building Materials Div., 3309 Concord St., Lancaster, Pa.

* Reg. U. S. Pat. Off. Product Mfg. by Pittsburgh Corning Corp.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

From 300° Below Zero

To 2600° Fahrenheit

NEWARK

Standard A.S.T.M. Testing Sieves

. . . featured by
NEWARK
Quality

NEWARK *for* ACCURACY

We have always made testing sieves with true mesh openings... an accuracy resulting from years of experience combined with highly skilled weaving.

NEWARK Standard Sieves range in openings from 4 inches down to 400 mesh. Diameter of sieves range from 3 inches to 12 inches. They are made to conform to A.S.T.M., NBS and ASA specifications.

* * *

Write for our catalog . . . if you would like further information before ordering.

NEWARK WIRE CLOTH COMPANY

350 VERONA AVENUE • NEWARK 4, NEW JERSEY

finishes and it is reported that such parts have been exposed for nine months to the acid fumes of a plating room and still retained their sheen. Similar parts showed no visible evidence of corrosion after exposure to Michigan weather conditions from October to March of last winter.

STEAM CLEANING COMPOUND

A HEAVY-DUTY steam cleaning compound, marketed under the trade name Steam-Off has been developed by Turco Products, Inc., Los Angeles, Calif. It appears to be particularly effective in the removal of stubborn heavy grease and dirt from iron and steel surfaces, concrete, brick and structural materials, gasoline and diesel engines, steam shovels, tractors, locomotives, and the like.

Extremely powerful in its penetrating and emulsifying action, this compound is said to result in reliably clean work, rinsing freely and leaving no film, curds, water spots or streaks. It was designed to function without loss of cleaning power in the hardest water and to prevent deposition of hard water scale in the coils and other parts of steam cleaning equipment.

Used as a stronger solution, Turco Steam-Off has the ability to remove unwanted paint as it cleans, making the product useful for complete overhaul or reclamation projects.

COMPLETE PLANT FOOD

A COMPLETE plant food that contains plant hormones, vitamin B_1, and all trace elements known to be necessary for healthy plants has been announced by Plant-Chem, Inc., recently organized firm in San Francisco, Calif. Known as Plant-Chem, the nutrient salts were formulated for growing plants with or without soil and for use in hydroponics or chemiculture. The product contains micro-nutrients in balanced proportions. The plant hormone, derived from phenylacetic acid is important in seed germination and starting new rootlets in transplanting. Plant-Chem, claimed to be the most complete plant food now on the market, is used in liquid form to supplement soil food and trace elements—recommended application for this purpose amounts to only about 0.125 gm. per plant weekly. The salts are packaged in sizes from 0.5 oz. to 80 lb., equivalent to 5 and 12,500 gal. respectively of ready-to-use nutrient solution.

FLOOR CLEANER

A LIQUID floor cleaner, called Floorlife, that can be applied by either hand or machine is available from L. Sonneborn Sons, Inc., New York. It is for use on wood or linoleum floors, and is said to be superior to soap-and-water in that it will not warp or raise the grain or discolor the wood. Furthermore, it leaves no soapy film, but does leave a coat of wax which can be buffed to high polish. Thus in effect it cleans and waxes in one application.

To use Floorlife, it is swabbed over the floor, the excess wiped off and with it the dirt, and the residual film of wax is lightly buffed. Its effectiveness in loosening dirt is illustrated by its ability to remove rubber heel marks from wood and linoleum.

CHEMICAL ENGINEERING NEWS

DuPONT BUYS WEST VIRGINIA SITE FOR PLASTICS PLANT

ACCORDING to an announcement by Arnold E. Pitcher, general manager of the plastics department, E. I. du Pont de Nemours & Co. is exercising options to purchase about 400 acres of land at Washington, near Parkersburg, W. Va., to provide plant space on which to expand the company's activities in the plastics field.

Among the first units to be built at the new location will be greatly expanded facilities for manufacturing nylon, methacrylate resin, and the new plastic polythene. Nylon has established itself in the field of textiles and bristles but the war delayed plans to exploit it as a plastic. Because of its high heat resistance and extreme toughness, work in connection with special war uses indicates a large potential for nylon in the general plastics field. The new plant will provide facilities for making nylon polymers, bristling filament, sheets, rods, tubes, and molding powders.

Another DuPont announcement revealed that about $10,000,000 will be spent in expanding facilities for making nylon yarn at its plant in Martinsville, Va.

SWISS ORIGINATORS OF DDT VISIT THIS COUNTRY

AT THE invitation of the United States Government, a group of Swiss scientists who pioneered in the work of developing DDT insecticides, recently came to this country for a series of conferences with American scientists. The governmental organizations participating in these conferences included the Army Committee for Insect and Rodent Control, The U. S. Department of Agriculture, the U. S. Public Health Service, the Tennessee Valley Authority, the Fish and Wild Life Commission, the National Research Council. Private laboratories interested in the development of DDT insecticides also were represented.

The group from Switzerland included Dr. Paul Läuger, director of research of J. R. Geigy, S. A. of Basle, who several months ago received from the University of Basle the honorary degree of doctor of medicine for his direction of the Geigy laboratory research that developed the DDT products; Dr. Paul Müller of the same company who was associated with Dr. Läuger in this work and who was the inventor of DDT insecticides; Dr. Robert Wiesmann who as entomologist of the Federal Agricultural Experimental Station at Waedenswil, Switzerland, published the first important papers of the effectiveness of DDT insecticides.

HARRISON HOWE LECTURES ESTABLISHED BY ACS

THE Rochester Section of the American Chemical Society will inaugurate during the coming year an annual lecture to be established as a memorial to the late Dr. Harrison E. Howe and to be known as the Harrison Howe Lectures. Dr. Howe was active in founding the Rochester Section and was one of its charter members. He was editor of *Industrial and Engineering Chemistry* from 1921 until his death in 1942 and was nationally known as a lecturer who in addresses to civic organizations pioneered in popularizing chemical science and industry.

Dr. Howe began his active career in Rochester, where he was employed by the Bausch and Lomb Optical Co. from 1904 to 1916. He was one of the leaders of a small group who, in February 1912, organized the Rochester Chemists Club, with the object of converting the organization into a Rochester Section of the American Chemical Society.

As a living memorial to one who made an outstanding contribution to American chemistry, the Harrison Howe Lectures will seek to stimulate enthusiastic interest in problems important to chemical progress.

H. WICKLIFFE ROSE HEADS AMERICAN TARIFF LEAGUE

ELECTION of officers by the American Tariff League has resulted in the selection of H. Wickliffe Rose as president. Mr. Rose is assistant to the president of the American Viscose Corp. He also is chairman of the board of the Philadelphia Textile Institute, a trustee of the Philadelphia Museum of Art, and a member of the executive committee of the Textile Research Institute.

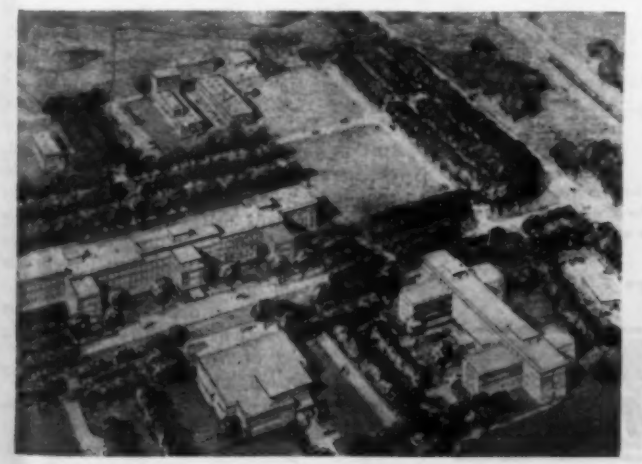
Other officers elected were: Roy C. McKenna, chairman of the board, Vanadium-Alloys Steel Co., 1st vice president; Dr. August Merz, Calco Chemical Division, American Cyanamid Co., 2nd vice president; Earle R. Van Vliet, vice president, Tubize Rayon Corp., treasurer; Bertrand W. Hall, secretary; and Ernestine D. Bohm, assistant treasurer. Among the members of the executive committee are Elvin H. Killheffer of DuPont and August Merz of American Cyanamid.

ELECTRONIC VULCANIZATION IN RUBBER INDUSTRY

INDUSTRY INVENTIONS, INC., an Ohio corporation, has been established to license the use of electronic vulcanization in the manufacture of rubber and plastic products. V. L. Smithers of V. L. Smithers Laboratories, Akron, Ohio will be vice-president and general manager of the new company.

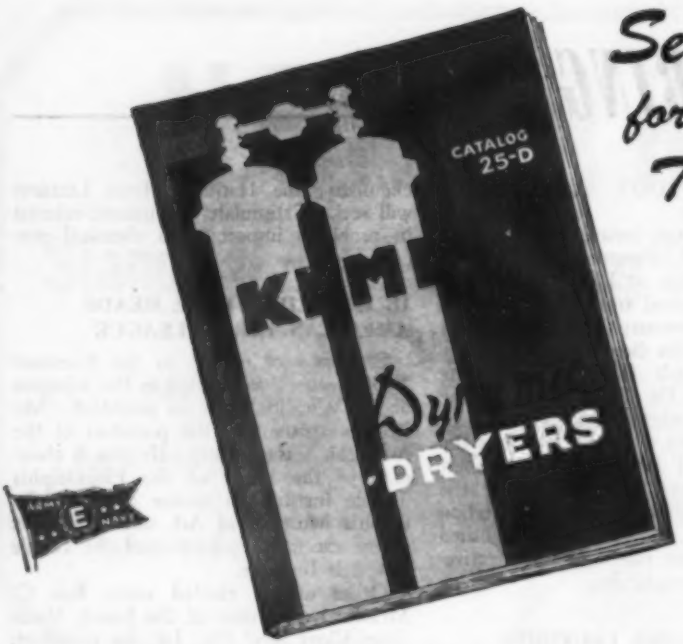
The B. F. Goodrich Co. and The Firestone Tire and Rubber Co. jointly hold patents for electronic processing of rubber and plastics and the new company will make the patents available to the rubber and plastics industries on a reasonable

Standard Oil Co. of New Jersey has approved plans for two major petroleum research centers, one at Linden, N. J., and one at Baton Rouge, La. This program ultimately may involve an expenditure of $8,000,000. To staff the new facilities, an increase of at least 20 percent in the present research and technical group of 2,100 will be necessary



Left—New Research center to be built at Linden

Below—New Esso laboratory to be built at Baton Rouge



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A wide variety of both standard and special units is also shown to illustrate how KEMP Dynamic Dryers can be profitably applied to your operations and processes.

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basis. The electronic method is said to require as little as one-eighth the time formerly required to vulcanize rubber and is already being used in the manufacture of many rubber and plastic products.

Other officers are: W. F. Avery of B. F. Goodrich, chairman of the board of directors; W. A. Fraser of Firestone, president; H. S. Woodruff of B. F. Goodrich, secretary; E. H. Schulenberg of Firestone, treasurer; and M. J. Moyer of Smithers Laboratories, assistant secretary.

INTERNATIONAL MINERALS TO BUILD TWO NEW PLANTS

PLANS for the construction of two fertilizer plants by International Minerals and Chemical Corp. were announced last month by Louis Ware, president of the corporation. A new $100,000 plant will be built in Mason City, Iowa, and a $200,000 plant will be erected in Hartsville, S. C., to replace a plant owned by the corporation there which was destroyed by fire in December.

The Mason City plant is being built to meet growing demands for fertilizers in Iowa and Minnesota and will produce a complete line of mixed fertilizers. The plant at Hartsville, which will be larger than the original one because of increasing demand in the South Carolina area, will produce mixed fertilizers and manufacture superphosphate. Construction on both plants will begin soon and they are expected to be in operation in time for the spring shipping season in 1946.

RESEARCH FELLOWSHIP AT RUTGERS UNIVERSITY

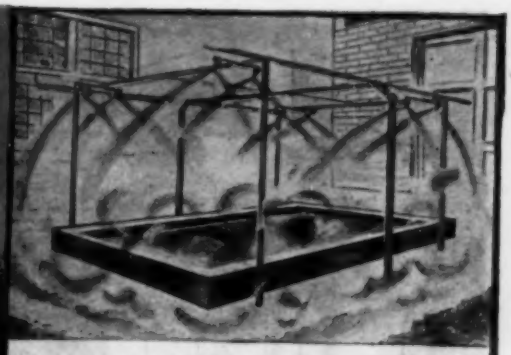
ESTABLISHMENT of a research fellowship at Rutgers University by the Benzol Products Co. of Newark was announced last month. The fellowship will be of a year's duration and has been established for the study of organic syntheses based on benzyl chloride and other benzyl compounds. The research will be under the supervision of Dr. Adolph Zimmerli of Rutgers and the fellowship appointment has gone to Robert B. Trelease of New Brunswick, N. J.

STANDARD OF INDIANA IN ENGINEERING RESEARCH

PLANS for the establishment of an engineering research department and for expansion and reorganization of present engineering activities have been announced by Standard Oil Co. (Indiana). The new program was disclosed by Dr. M. G. Paulus, vice president, who stated that George W. Watts has been named director of engineering of the manufacturing department and D. A. Monro, chief designing engineer of the department. Under the new plans Mr. Watts will be in charge of all engineering work in the manufacturing department but will devote his time principally to the activities of the engineering research department. All other engineering activities will be under the direct charge of Mr. Monro.

P. L. Krauel has been appointed chief engineer of the engineering division, Whiting Refinery, where the company's largest engineering unit is located. Mr.

How Do We KNOW that



OPEN TANKS OF FLAMMABLE LIQUID

TRANSFORMERS

"AUTOMATIC" FIRE-FOG QUENCHES REALLY TOUGH FIRES?

DRYERS AND OVENS

That's simple—we put FIRE-FOG to the test.

Here's what we do:

In our Test Yard at Youngstown we recreate actual conditions. If it's a question of extinguishing a quench tank fire, say, or a blazing transformer, we "set the stage" for the fire, exactly duplicating conditions where such fire hazards exist.

Then we know, almost to a second, how long it takes FIRE-FOG to quench fire; the most effective type and arrangement of FIRE-FOG nozzles; the amount of water used, etc.

Thus we eliminate guess-work. And what soul-satisfying comfort there is in the thought that FIRE-FOG is *automatic* in operation—an alert fire guard on duty 24 hours a day.

FIRE-FOG stops fires in Mixers, Coaters, Ovens, Dryers, Dip Tanks and flammable liquid processing, handling and storage facilities.

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"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN, OHIO . . . . . OFFICES IN 36 CITIES

"Automatic" Sprinkler manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories and approved by Factory Mutual Laboratories.

All working parts attached to cover

So light that it can be borne entirely by the piping — with valve and float mechanism mounted on cover, and all piping connections on the body, the Adsco Vertical Steam Trap need never come out of the pipe line.

If cleaning or adjustments are necessary the cover with all working parts can be removed quickly without disturbing the piping. By keeping an extra cover with valve assembly on hand this "spare" can be substituted in a few minutes with practically no interruption to service, and the original assembly taken to the work shop for servicing.

DOUBLE LIFE. This trap also has a reversible valve and reversible seat of non-corrosive stainless alloy steel which gives it double life. Write for Bulletin No. 35-86E and prices.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, NEW YORK
Makers of "UP-TO-DATE" Steam Line Equipment For Over 65 Years

Krauel will serve as the administrative head of the division which has been enlarged to include six departments, each to be headed by an assistant chief engineer.

The oil design department will be supervised by W. G. Guild, acting assistant chief engineer. A. T. Milbrook, assistant chief engineer, will supervise the utility design department. W. K. Brown has been appointed acting assistant chief engineer in charge of the newly-created plant engineering department. C. E. Dyckman is made assistant chief engineer, estimating department, and will continue to direct and supervise the work of the estimating engineers. W. R. Burrows will be in charge of the newly-created engineering development department, with the title of assistant chief engineer.

CARNEGIE TECH CONFERENCE ON INSTRUMENTATION

An educational conference on instrumentation sponsored by the Carnegie Institute of Technology and The Instrument Society of America has been arranged for October 16-18, 1945.

The program will be divided into two parts. The first part covers the requirements expected by industries and the second part will be devoted to present training in instrumentation.

Chairman of the Committee is Dr. B. R. Teare, Jr., Head of the Department of Electrical Engineering of the Carnegie Institute of Technology, Pittsburgh. Due to traveling requirements, the conference is limited to 50 and invitations will be sent to those in the order in which applications for attendance are received. Such applications should be made to Dr. Teare.

ARCO PLANS LABORATORY FOR PAINT RESEARCH

Plans for the immediate construction of a new two-story research laboratory for the development of improved paints, lacquers, varnishes and new industrial coatings were announced last month by Howard E. Wise, president of The Arco Co. The laboratory, which is scheduled for completion early next year, will be of structural steel and brick construction and will be located adjacent to the company's general offices at 7301 Bessemer Ave., Cleveland.

The upper floor will be given over entirely to product development work and the ground floor to an evaluation and testing laboratory, resin research, and a pilot plant for experimental production of new synthetic resins. Transfer of research activities to the new building means that work in the existing laboratory will be devoted solely to production control and service.

DIAMOND ALKALI ACQUIRES SITE IN GULF AREA

Latest among the companies which plan to enter into the production of chemicals in the south is The Diamond Alkali Co. of Pittsburgh, which has announced that its postwar plans involve manufacturing and marketing activities in the Gulf area. As a preliminary step the company has

Three Ways To Cut Production Costs –
Variable Speed
Sterling Speed-Trol is a proven, self-contained, infinite variable speed power unit. With Speed-Trol you can get the exact speed for maximum production.
H.P.—From ½ to 15 Ratios—From 2:1 to 6:1
STERLING SPEED-TROL MOTOR
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Sterling Slo-Speed (Modern Gear System) Motors give you a complete power drive in one soundly engineered—compact—flexible—ultra efficient unit.
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STERLING SLO-SPEED MOTORS
Normal Speed
Sterling Standard Klosd Motors are the latest word in design, incorporating important improvements including patented Herringbone Rotors.
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Saves Time at every operation

Everlasting Valves are completely opened or closed with a 70-degree turn of the operating wrench . . . and the operation is easy, because the wrench gives ample leverage.

Add to this valuable time-saving feature the many other important advantages of the Everlasting Valve . . . its drop-tight seal, its self-grinding action at each motion, its provisions against damage to disc and seat, and its everlasting wearing qualities . . . and you have a valve that is literally unequalled for many services on process lines, emergency shut-offs, equipment outlets, boiler blow-off fire protection, etc. Write for bulletin.

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purchased several hundred acres of land at Houston, Tex., adjacent to the Houston Ship Channel. No details were made public regarding the time when construction will begin or of the chemicals to be produced.

COLUMBIA OFFERS COURSE ON SYNTHETIC FIBERS

UNDER the direction of the Extension Division, Columbia University has arranged a new evening course in new synthetic textile fibers, yarns and materials. The 15 lecture course, conducted by Herbert R. Mauersberger, textile consultant and technical editor of *Rayon Textile Monthly*, will include all synthetic fibers, yarns and fabrics other than rayon. Their classification, physical, chemical and microscopical properties and characteristics will be explained on basis of samples, films and exhibits. The course will open on the evening of October 1 and will be given in Hamilton Hall.

CELANESE CORP. TO SET UP CENTRAL LABORATORY

ESTABLISHMENT of a central laboratory in keeping with the increasingly broad scope and versatility of its research activities in the three fields of related synthetics —textiles, plastics and chemicals—has been announced by the Celanese Corp. of America. As an initial step in concentrating its technological and research activities, the corporation has acquired the buildings at Summit, N. J., formerly occupied by the Edison Junior High School. The building will be converted into a modern industrial laboratory where will be consolidated the corporation's experimental and research work now carried on at various plants throughout the country.

LION OIL CO. MAKES PLANS FOR PRODUCING CHEMICALS

ON July 24, stockholders of the Lion Oil Refining Co. of El Dorado, Ark., ratified proposals to change its name to Lion Oil Co. and to broaden its corporate powers so as to permit of its manufacture of a wide variety of products. Col. T. H. Barton, president of the company, said it would soon be advantageous for the company to engage in production of new products and new materials developed in the petroleum industry. He said the company planned broad postwar expansion into the chemical field. Through a subsidiary, the Lion Chemical Corp., the company has been operating a $30,000,000 ammonia plant which, Col. Barton said, might easily be converted into a fertilizer plant. Lion has the right to buy this plant through direct negotiation with the government or by matching the highest bid.

MERGER OF A. C. HORN AND GENERAL PRINTING INK

STOCKHOLDERS of the A. C. Horn Co. of Long Island City have ratified the arrangement to consolidate with the General Printing Ink Corp. of New York. The Horn company becomes a division of General Printing Ink and A. C. Horn will be a member of the board and A. E. Horn will succeed him as president of the

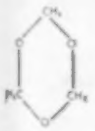
NEW CHEMICALS FROM DU PONT

"HARNESSED" FORMALDEHYDE

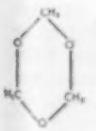
TRIOXANE

ADVANTAGES IN USE—Can be used as a source of anhydrous monomeric formaldehyde for reaction with various materials. Provides better control of reaction, better yields and quality of product, shorter reaction time, smoother reaction than is possible with aqueous formaldehyde or other formaldehyde polymers.

STABILITY AND DEPOLYMERIZATION—Stable in alkaline or neutral solutions. Depolymerized to formaldehyde by small amounts of strong acid or acid-forming materials. Depolymerization rate is easily controlled.



SOLUBILITY AND MISCIBILITY—Miscible with many types of organic compounds; dissolves a wide range of materials such as phenols, aromatic hydrocarbons, amides such as urea, and many others. Trioxane increases the solubility of the protein zein in water and alcohols. Trioxane acts also as a plasticizer and as an anti-gelation agent for zein.



USE IN ORGANIC REACTIONS—Trioxane can be used in reactions with such compounds as phenols, amides, amines, proteins, hydrocarbons, and in general, with compounds with which formaldehyde will react in slightly acidic media.

TRIOXANE

Cyclic trimeric polymer of Formaldehyde

PROPERTIES

Colorless, crystalline compound	
Molecular Weight	**90.05**
Odor	**Mild, Pleasant**
Melting Point	**61°C**
Boiling Point	**115°C**
Vapor Pressure	
25°C	13 mm
86°C	283 "
114.5°C	759 "
129°C	1212 "
Flash Point	**45°C**
Density (molten) @ 65°C	**1.170**
Solubility	
Water	Readily Soluble
Alcohols	" "
Ketones	" "
Ethers	" "
Esters	" "
Chlorinated Hydrocarbons	" "
Aromatic Hydrocarbons	" "
Vegetable Oils	" "
Naphthalene	" "
Phenol	" "
Petroleum Ether	Slightly Soluble

AVAILABLE in limited quantities for research and development. Write for more data, samples and technical advice: E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals, Field Research Section, Wilmington 98, Delaware.

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OILJAK production facilities, engineers, designers, and shopmen are at your service when you have a question, or a problem having to do with the design, fabrication, assembly, or manufacture of a product in light metals—to solve it satisfactorily, economically, and within the allotted time.

Our experience in manufacturing new, unusual and intricate parts and products, in a minimum of operations, with great precision, and at reasonable cost is available for planning and carrying out a wide variety of projects.

That service may be helpful to you. We invite your inquiries.

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FINISHING · ASSEMBLING

The OILJAK MANUFACTURING CO., Inc.
MONTCLAIR, N. J.
The Job Complete — from blueprint to finished product

Horn division. It is contemplated to change the name of the consolidated company to the Sun Chemical Corp. Plans have been made for joint research into many fields including paints, industrial finishes, adhesives, plastics, resins, new methods of pigment dispersion, and general chemical research.

H. CARL WOLF MANAGING DIRECTOR OF GAS ASS'N

SUCCEEDING Alexander Forward who is retiring from active business after 22 years as executive head of the American Gas Association, H. Carl Wolf takes up the duties of managing director on October 1. Mr. Wolf was elected president of the Atlanta Gas Light Co. in 1938, which position he still holds. Until recently he also served as president of the Mobile Gas Service Corp. and the Florida Public Utilities Co. In his new position Mr. Wolf will play an important part in directing the vastly expanded program of research, sales promotion and advertising for which the gas industry and allied companies throughout the country have pledged more than $1,500,000 a year for financing development work which will continue for three years.

GRADUATE COURSES OFFERED AT NEW YORK UNIVERSITY

GRADUATE study looking toward higher degrees or selected advanced courses are again being offered at New York University. As all graduate courses are given in the evening, they are available to men in industry. The various courses now offered by the Department of Chemical Engineering under the graduate division of the College of Engineering include: food engineering, food technology, unit processes of organic synthesis, metallurgy, surface finishes, chemical engineering calculations, synthetic resins and plastics, powder metallurgy, distillation, industrial chemistry, chemical engineering thermodynamics, and principles and practice of industrial research.

ANNUAL WATER CONFERENCE OF ENGINEERS' SOCIETY

PLANS are now in progress for holding the Sixth Annual Water Conference of the Engineers' Society of Western Pennsylvania. The conference is scheduled to be held in the Hotel William Penn, Pittsburgh, on October 22-23. A tentative program giving subjects and speakers soon will be released.

McGRAW-HILL ADDS TWO NEW EUROPEAN REPRESENTATIVES

APPOINTMENT of Stanley A. Tucker and Howard P. Whidden, Jr., to the staff of the company's news bureau in London was announced last month by James H. McGraw, Jr., president of the McGraw-Hill Publishing Co. These men will provide all McGraw-Hill publications with news from western Europe which concerns their particular fields and will develop articles about technical and economic trends of interest to American readers.

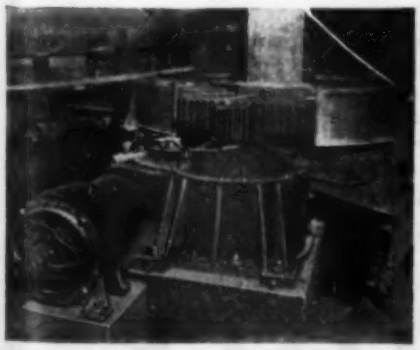
Jones

WORM-HELICAL SPEED REDUCERS

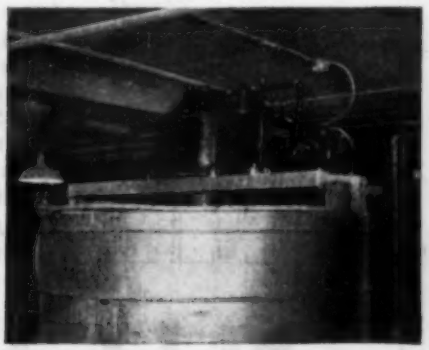
-for Vertical Shaft Drives

THESE machines fill a long felt need for double reduction units of the fully enclosed type to be used for agitators, mixers, ore roasters, bending rolls, etc., requiring a vertical shaft drive. Built in standard ratios in various types of assemblies ranging from 40 to 1 to 250 to 1 for all common motor speeds and a wide range of horsepower ratings.

Jones Bulletin No. 75 covers complete details on these Worm-Helical Speed Reducers, with rating tables, dimension diagrams, torque charts and other application information. We shall be pleased to send you a copy.



• Jones Worm-Helical Speed Reducer on ore roaster with section of dust guard removed to show final gear reduction.



• Jones Worm-Helical Speed Reducer driving a lacquer agitator. A simple design prevents leakage of oil along the vertical low speed shaft.

• Jones Worm-Helical Speed Reducer on a paper mill agitator drive.

W. A. JONES FOUNDRY & MACHINE CO., 4415 Roosevelt Road, Chicago 24, Illinois

TO HOLD LOADS *Accurately* WITH SAFETY

The positive acting friction brake on the Reading Multiple Gear Chain Hoist makes possible accurate positioning of the work or load with complete safety.

The maple inserts in the brake wheel hold the load tightly against the friction disc till the load is to be moved. Lowering requires only that the operating chain be pulled in the down direction. The load lowers without slipping or speeding up.

Each Reading Multiple Gear Chain Hoist is so well built that it has a guaranteed overload capacity of 25% in every size from ¼ ton to 25 tons.

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PACIFIC PROCESS INDUSTRIES

TRENDS • EVENTS • DEVELOPMENTS

JOHN R. CALLAHAM, Pacific Coast Editor, San Francisco, Calif.

ALUMINA-FROM-CLAY UNIT TO OPERATE SOON

COLUMBIA METALS CORP., which is building a $4,000,000 alumina plant at Salem, Ore., has assembled a stockpile of 15,000 tons of alumina-bearing clay with which to start operations soon, it was reported in July. This clay will yield 36-37 percent alumina, according to James O. Gallagher of Seattle, president of the company.

The clay with which the plant, now nearly completed, will start operations was mined in Cowlitz county, Wash., where the company has proved a deposit of 15,000,000 tons. Other deposits are located near Molalla, Ore., Hobard Butte, Mont., and Troy, Ida. The plant, being built by Chemical Construction Co. for Columbia Metals, is financed by DPC.

WESTERN SULPHURIC ACID PRODUCTION INCREASES

PRODUCTION of sulphuric acid in the 11 western states for 1944 increased some 91 percent over that for 1939, according to recent WPB figures. The 16 western acid plants accounted for 8.4 percent of the nation's production during 1944 as compared with 7.8 percent during 1939. Figures on the western states were given as follows (short tons):

	1944	1939
Production	718,120	376,423
Consumed in producing plants	94,583	38,611
Stocks at year's end	27,008	

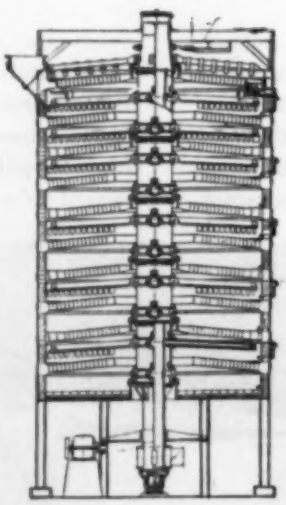
The present western producers, type of process used and plant locations are as follows:

American Smelting & Ref. Co.	Garfield, Utah	Contact
	Selby, Calif.	Contact
Anaconda Copper Mining Co.	Anaconda, Mont.	Chamber
Apache Powder Co.	Douglas, Ariz.	Contact
E. I. duPont de Nemours & Co.	Wash.	Contact
General Chemical Co.	El Segundo, Calif.	Contact
	Port Chicago, Calif.	Contact
	Richmond, Calif.	Contact
	Denver, Colo.	Contact
Inspiration Consolidated Copper Co.	Morenci, Ariz.	Contact
Phelps Dodge Corp.	Douglas, Ariz.	Chamber
Standard Oil of Indiana	Casper, Wyo.	Contact
Stauffer Chemical Co.	Stege, Calif.	Contact
	Vernon, Calif.	Contact
	Torrance, Calif.	Contact
	Dominguez, Calif.	Contact

DDT EXPERIMENTS REPORTED BY ENTOMOLOGISTS

RESULTS of last season's work with DDT have now been reported by entomologists at the University of California, Berkeley. Based on preliminary experiments, DDT

Furnaces Are Known by the COMPANIES *they serve*



Since 1889, Nichols Herreshoff Multiple Hearth Furnaces have served in the—

"BEST COMPANIES"

Leaders in their respective fields.

And always the furnaces have proved dependable, economical and efficient.

Thousands of furnaces have been installed—scores of materials thermal processed.

On this background of long experience, technical knowledge and operating practice, Nichols offers an Engineering Service as consulting, designing and contraction managers for the construction of new, or the modernization of plants for—

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—of ores and concentrates, filtering clays, core sands, chemical salts, etc.

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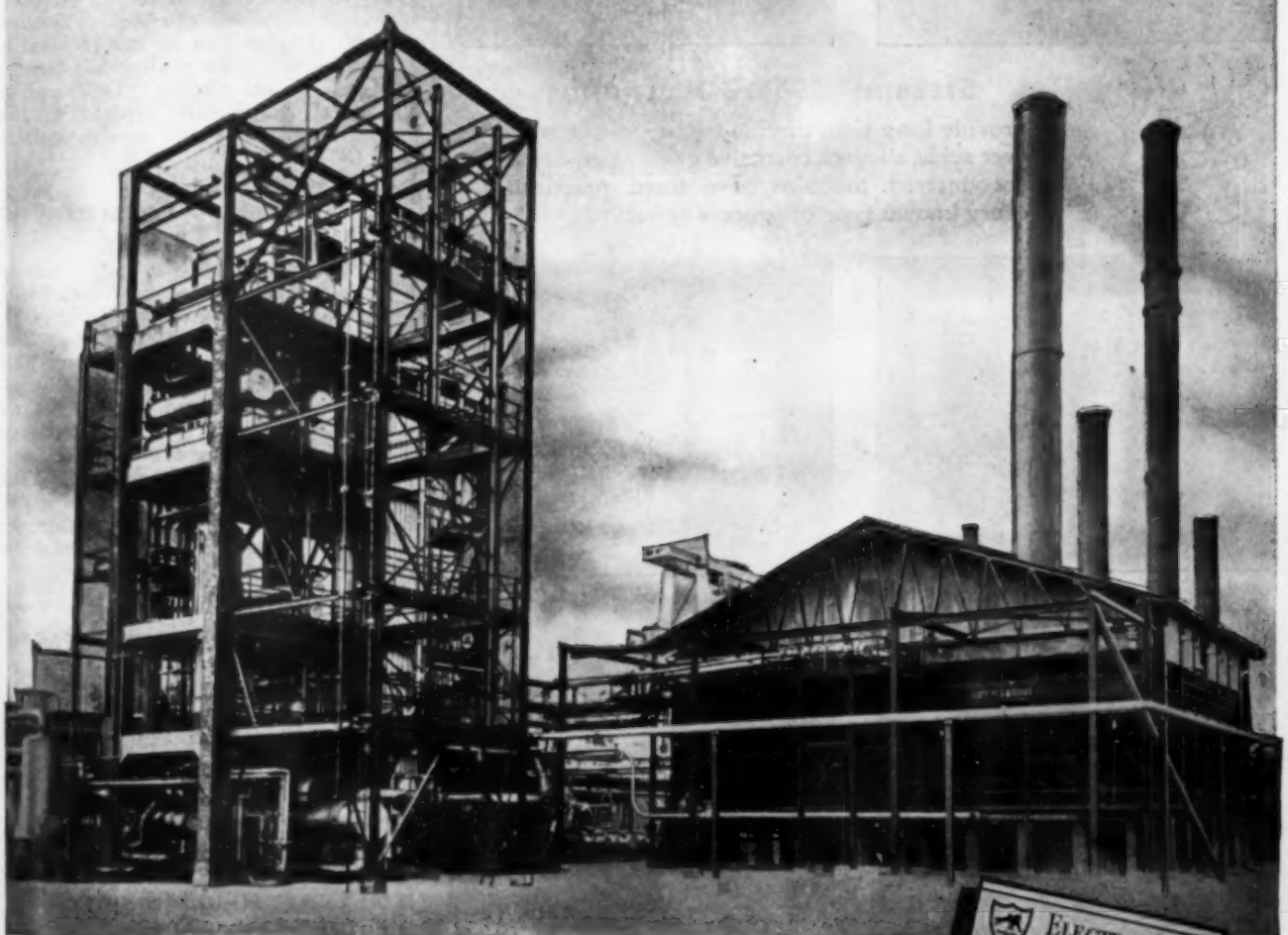
MONTREAL, P. Q.

Old-Age Insurance for Cracking Tubes

Chromium steel cracking tubes are used in this modern furnace installation because good resistance to oxidation and hot oil corrosion is a "must." Laboratory and field tests clearly show that the life of tubes—and of tube supports, too—varies with chromium content of the steel.

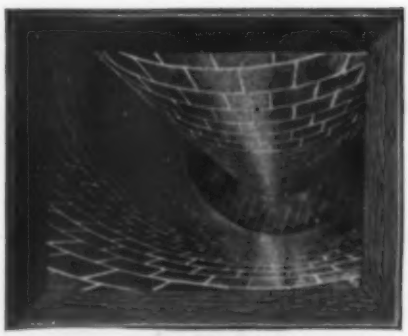
In addition to the 4 to 6 per cent chromium steels so commonly used in refining equipment, many high-chromium steels are specified for high-temperature processes and the handling of highly corrosive crudes. Chromium steels should always be considered for applications where corrosion or oxidation resistance is required.

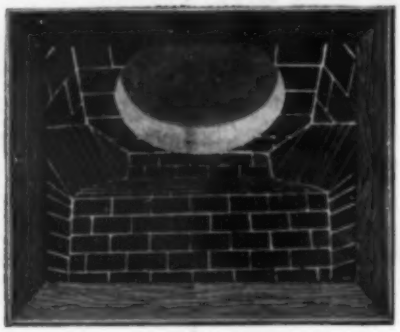
BUY UNITED STATES WAR BONDS AND STAMPS



(Picture courtesy, The Lummus Co.)

Other interesting uses of stainless steel are described in ELECTROMET REVIEW published by ELECTRO METALLURGICAL COMPANY, the Unit of UNION CARBIDE and CARBON CORPORATION that produces alloys for making steel. If you are an executive, engineer, or designer you can be put on the mailing list for ELECTROMET REVIEW by sending your name on your business letterhead to ELECTRO METALLURGICAL COMPANY, Room 328, 30 East 42nd Street, New York 17, N. Y.





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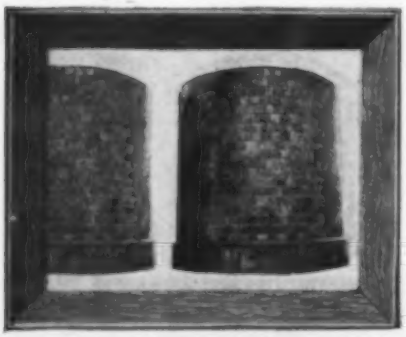
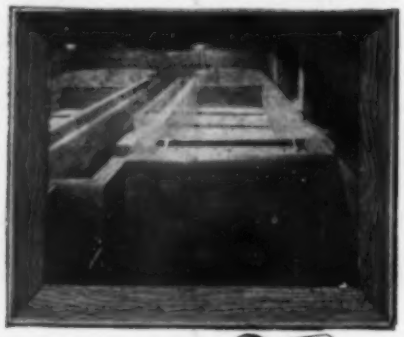
provide long time trouble-free operation wherever acids, alkalies, corrosive gases or vapors are encountered. Stebbins have lined practically every known type of process vessel.





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permit quick and easy assembly in limited space and at locations in plants where the problem of handling other types of tanks is troublesome. Call in Stebbins on any lining or tank job.

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shows promise for control of lygus bugs on alfalfa seed crop, onion thrips, black scale on olives and codling moth on walnuts. Its use seems excellent for control of flies in dairy barns. On almond trees, DDT should be used with caution; sprayed trees suffered complete defoliation. As a vapo-spray or dry dust mixed with sulphur, the insecticide appeared effective against the grape leafhopper adults and nymphs. Used as vapo-sprays in controlling pea insects, different concentrations indicate the kill of pea aphids is proportional to the amount of DDT present. Higher concentrations were effective in reducing populations of a predaceous fly. DDT was effective in killing walnut aphids and predators. A spray controlled thrips and reduced spotted wilt in tomatoes but seriously damaged plants.

University entomologists also are experimenting with several new insecticides. Studies are being made with Shell DD, sabadilla, and 666. Shell DD, a fumigant, is being used on wire worms and nematodes on truck and field crops. Sabadilla, made from the seeds of a Mexican lilaceous plant, is being used on insects formerly requiring such scarce products as rotenone, pyrethrum and nicotine. Developed in England and recently brought to this country, 666 is in some ways comparable to DDT.

MANUFACTURING FACILITIES EXPANSION IN WEST

THE CHEMICALS, coal and petroleum products industries have spent over $400,000,000 for manufacturing facilities expansion from July 1, 1940 through June 30, 1944, according to WPB figures. This amounts to about 14 percent of the national total. Included are facilities for production of catalysts for aviation gasoline, alcohol, alumina and aluminum, plastics materials and basic chemicals. The following table shows the cost of manufacturing facilities expansion for these industries during this four-year period (in millions of dollars):

	Feders	Private	Total	Percent U. S. Total
Arizona	....	*	....	....
California	$139	$162	$301	10.6
Colorado	6	1	7	0.3
Montana	....	1	1	0.04
Nevada	8	*	8	0.3
New Mexico	6	9	15	0.5
Oregon	7	3	10	0.4
Utah	22	1	23	0.8
Washington	5	3	8	0.3
Wyoming	19	13	32	1.1
Total Western States	$212	$193	$405	14.3

* Less than $500,000.

METALLIC SODIUM PRODUCED FROM MAGNESIUM UNIT

SODIUM metal is now being produced from the reconverted DPC ferrosilicon magnesium plant operated by Electro Metallurgical Co. at Mead, Wash., according to recent reports. After more than three months preparation, production got under way during August and will be steadily increased until a force of about 350 personnel will be employed. No production of metallic calcium has yet been reported. Original capacity of the plant has been placed at 20,000–24,000 tons yearly

Chemical plants all over the country have found that WILFLEY Acid Pumps never fail to turn in top-ranking performance in the handling of acids, corrosives, hot liquids and mild abrasives. This is the pump without a stuffing box—therefore the pump that is free from stuffing-box troubles. Effective sealing blades—no leakage problem. No rubbing contact. Works equally well in both intermittent and continuous operation. 10- to 2,000-G.P.M. capacities. 15- to 150-foot heads, and higher. Individual engineering on every application. Write or wire for complete details.

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of metallic magnesium by the ferrosilicon process and about an equal tonnage of ferrosilicon. G. A. Griffin is superintendent of the Mead plant.

NEW ADHESIVES PLANT SCHEDULED FOR OREGON

CONSTRUCTION of a new synthetic resins plant will be started during early October at Springfield, near Eugene, Ore., according to an announcement of the Casein Co. of America, a division of the Borden Co. The plant, which will cost in the neighborhood of $200,000, will produce principally phenolic resins for the plywood industry and is expected to be in operation by early 1946. Capacity will probably be about 75,000 lb. daily or about the same as the firm's present synthetic resins plant in Seattle.

In addition, the plant will produce about 1,000,000 lb. of formaldehyde monthly, an essential in the production of synthetic resins and plastics. It will be the first large-scale formaldehyde operation on the Pacific Coast, according to C. S. Leonardson, western manager of the company.

ELECTRONIC EQUIPMENT EXPANDS FOR POSTWAR

ELECTRON EQUIPMENT CORP., South Pasadena, Calif., manufacturer of electronic industrial equipment, recently announced an enlargement of its production facilities in preparation for the postwar market. Only firm of its kind in the west, the company is preparing to market a wide range of electronic frequency changers, power rectifiers, and motor controls. Plans are in progress for national distribution.

New officers of the company are: Harrison Matthews, president and general manager; William A. Godshell, vice-president; Howard Burrell, secretary; N. J. Redmon, treasurer; and Dudley B. Clark, chief design engineer.

CHEMICAL FIRM EXPANDS RESEARCH FACILITIES

WITH the purpose of expanding its postwar research program, A. R. Maas Chemical Co., South Gate, Calif., has just completed and is now occupying a new research building having 3,700 sq. ft. of floor area and capable of accommodating, when fully occupied, a staff of 10 researchers. The new laboratory consists of three separate laboratory work rooms, a pilot plant shop, a darkroom for research on photographic processes, library facilities, store rooms and two private offices. The research program will be under the direction of Fred C. Bowman, director of research, while laboratory work will be supervised by W. M. Ramsey, chief chemist.

HUGE EXPANSION IN NORTHWEST PULP MILLS

NEARLY $15,000,000 will be spent by Crown Zellerbach Corp. to expand and improve its 5 pulp and paper mills in the Pacific Northwest, it was announced recently. Work will start as soon as materials are available. Long-term contracts for furnishing 45,000–60,000 tons of

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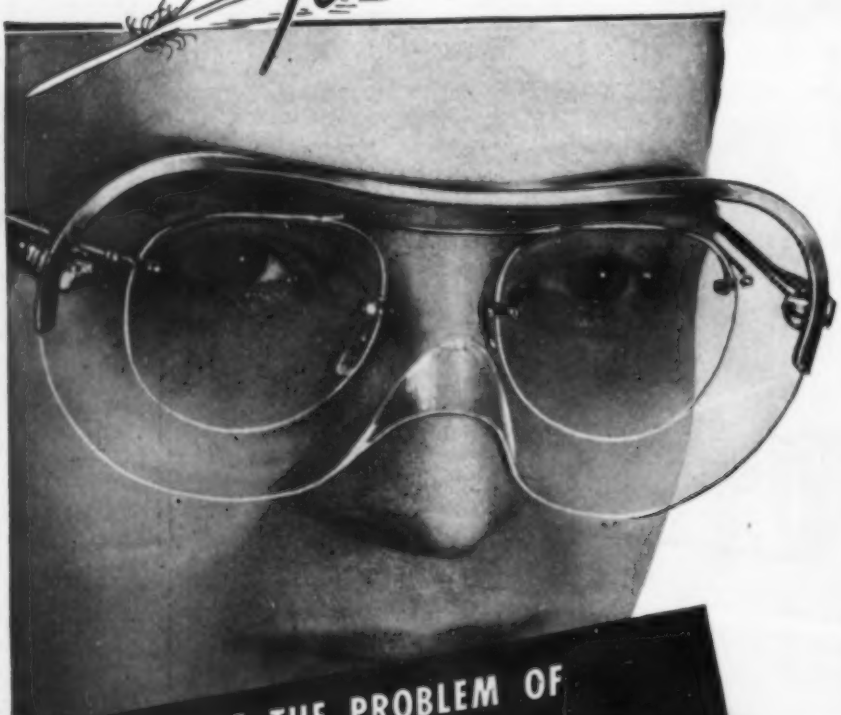

TO SOLVE THE PROBLEM OF KEEPING SAFETY SPECTACLES ON WORKERS IN SEMI-HAZARDOUS JOBS

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coated magazine paper annually are largely responsible for the expansion.

Improvements in mill facilities include changes in the West Linn, Ore., mill where coated paper will be produced. Coating clay will be used in liberal quantities to result in a substantial reduction in pulpwood usage and therefore promote forest conservation, officials said. New construction is under way at the Port Townsend, Wash., kraft mill where a complete kraft chemical recovery unit is being added. A new drum barker also will be installed so the mill can take delivery of cordwood cut in farming communities. A hydraulic barker will be added to the Port Angeles newsprint mill in western Washington. The sulphate mill at Camas, Wash., will be increased to almost double its present capacity and a sulphate bleaching plant will be installed, the first in any of the company's plants.

INSECTICIDE DUST BOMBS TO BE PRODUCED IN OREGON

WITH plans to manufacture insecticide "dust bombs" that will combat orchard pests, Blair Industrial Laboratories, Inc., of New York filed articles of incorporation in Oregon in mid-August. Capitalized at $50,000, the new firm proposes to establish a manufacturing plant in Salem, Ore. The process of exploding insecticide bombs over orchards is claimed to be cheaper per acre than spraying and it is reported that all proven insecticides except dry sulphur are adaptable to the system. Depending on whether solution or dust is used, the explosion creates a mist or cloud, which is suspended in the atmosphere from 3 to 45 min., penetrating where spray fails to reach.

NEW AMMONIA PULP PROCESS TO OPERATE

CLOSED since August, 1943, because of a log shortage, the Shelton, Wash., pulp mill of Rayonier, Inc., is scheduled to reopen during October. The plant will use the DuPont ammonia process in place of the standard sulphite method for production of rayon-grade wood pulp, thus becoming the first plant in this country to operate on the new process. The use of ammonium bisulphite in the digestors is reported to show advantages over calcium bisulphite in the concentration of waste liquors for fuel and in the recovery of chemicals for reuse.

AGRICULTURAL LABORATORY SET UP BY SHELL

GROUND was broken last month by the Shell Oil Co., for a $500,000 agricultural field laboratory six miles north of Modesto in central California. The 142-acre project will be operated in the interests of Shell Oil Co., Inc., Shell Development Co. and the Shell Chemical Division of Shell Union Oil Corp. This new laboratory will maintain five general departments in the fields of entomology, plant pathology, plant physiology, nematology and horticulture, as well as units specializing in soil sciences and equipment development.

Principal activities of the experimental farm will be the testing and adaptation of various petroleum chemicals for use as

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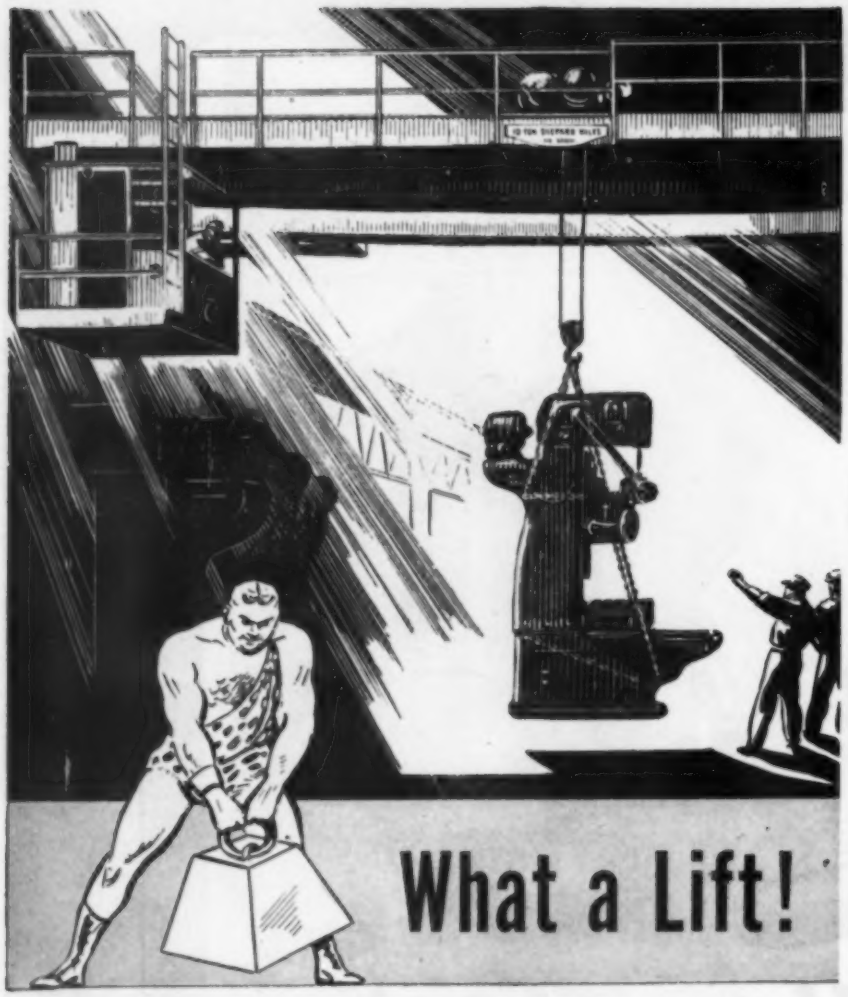

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agricultural sprays, dusts, fumigants, plant growth substances, fertilizers and weed eradicants. Another study will be the development and application of plant hormones. There will be large scale testing of insecticides on deciduous, citrus and shade trees, as well as on vines, vegetables, cereal and forage crops.

Dr. Roy Hansberry, for seven years associate research professor of entomology, New York State College of Agriculture, will be in charge of the experimental farm.

SYNTHETIC LATEX UNIT PLANNED FOR LOS ANGELES

PLANS to install a new synthetic latex production unit at the Los Angeles Synthetic Rubber Project plant operated by the U. S. Rubber Co., near Torrance, Calif., were recently announced by F. S. Carpenter, manager of the plant. Rubber Reserve Corp. has authorized appropriations and the cost is reported to be "several hundred thousand dollars." A new continuous polymerization system will increase the present production capacity by 30-50 percent by connecting 12 of the plant's 24 reactor vessels into an integrated production chain.

Engineering work is under way, and the new unit is expected to be in production by the end of the year. The plant then will provide special types of liquid GR-S rubber for the entire Pacific Coast rubber products industry, Mr. Carpenter said. The latex may be used to form rubber coatings on such metal parts as grab rails, bolts, communications wire, nuts and perforated connection plates or to make foam rubber suitable for seat cushions. Its most important application is in covering tire cord fabric through dipping.

MAGNESIUM CASTING PROCESS DEVELOPED BY UNIVERSITY

A NEW process in magnesium casting has been developed at the University of California laboratories, according to Dr. Ralph Hultgren, associate professor of physical metallurgy. Working at the request of the War Metallurgy Committee, Dr. Hultgren and David W. Mitchell found that small grain size, which is necessary for a strong metal product, may be achieved by stirring the metal in the pot.

Present practice in treating magnesium requires that it be superheated several hundred degrees and held there for at least fifteen minutes, Dr. Hultgren says. This is expensive in time and heat, and soon wears out the giant iron pots used in the process. Research at the university proves that superheating can be replaced by stirring, which can be done at a comparatively low temperature. Grain size is fifty times smaller than the unstirred; most of the grain refinement occurs during the first minute of stirring.

ISOPRENE PLANT SCHEDULED FOR CALIFORNIA

PLANS to build a $2,000,000 isoprene recovery and purification plant in Torrance, Calif., which will be the largest isoprene installation in the country, were announced recently by vice-president Jan Oostermeyer of the Shell Chemical Division of Shell Union Oil Corp. Ground was

MODERN DEVELOPMENTS OF GASKET RESEARCH

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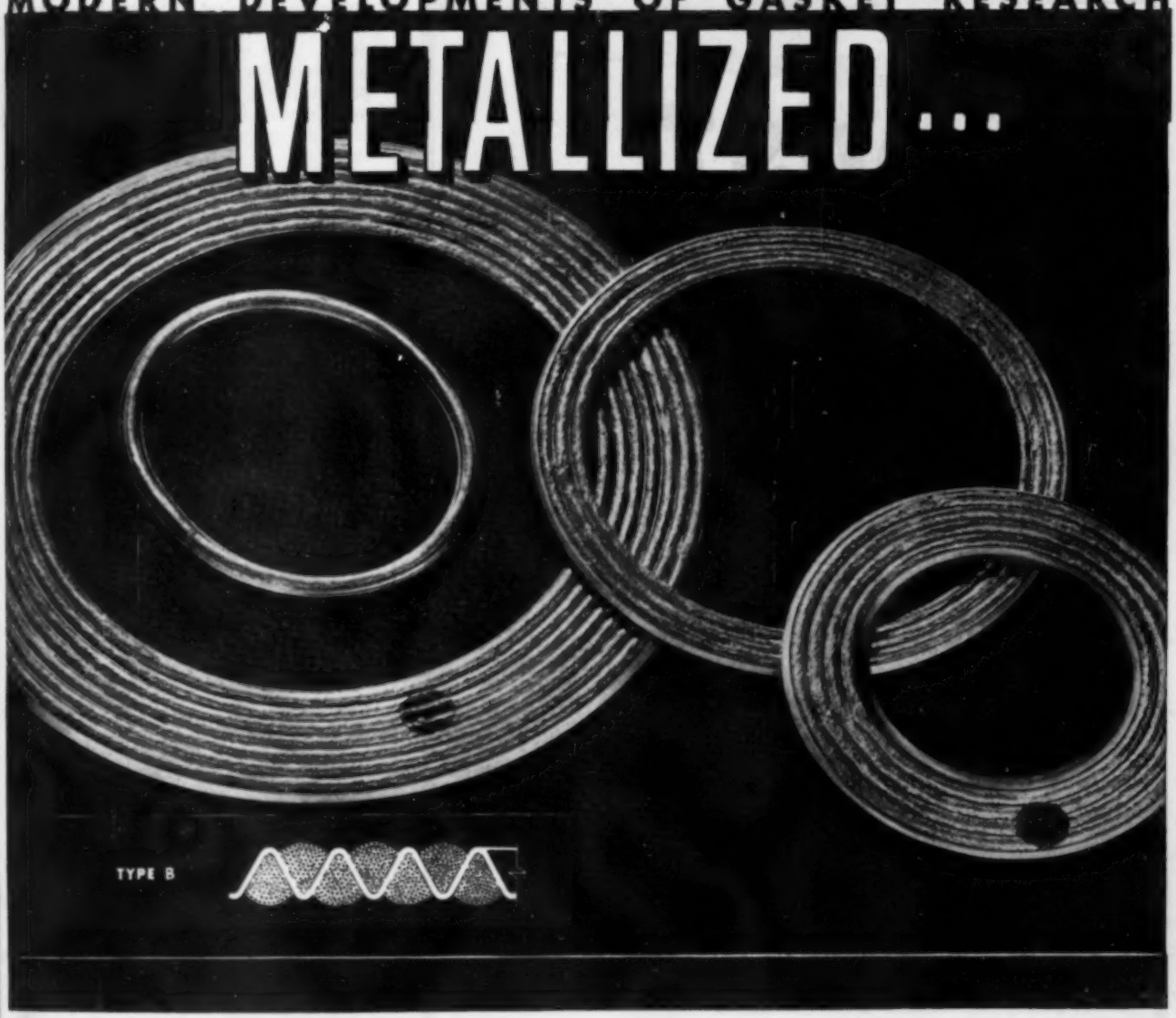

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broken for the plant in September on land adjacent to the corporation's butadiene works. It is reported that the new plant will more than double the government's present production of isoprene, which is used in manufacture of synthetic rubber, especially in automobile and truck inner tubes.

NEW SYNTHETIC RESINS PLANT FOR SEATTLE

EXPANSION of its chemical manufacturing facilities on the West Coast was announced during August by Monsanto Chemical Co. through its Seattle subsidiary, I. F. Laucks, Inc. The company will erect a modern plywood adhesives plant on a 29-acre site just south of Seattle, it was announced, and the new facility will combine Laucks operations now carried on in the two present Seattle plants. Produced at the new location will be synthetic resins for adhesives, and coatings and wood preservatives now made in the two Laucks plants. It was indicated that offices and research laboratories of the subsidiary which Monsanto acquired last year will eventually be moved to the new location.

MONOPOLY CHARGED AGAINST WESTERN PRECIPITATION

TO RESTRAIN an asserted monopoly in the distribution of electrical precipitation units, an antitrust suit charging misuse of patent rights was filed in the U. S. District Court in Los Angeles, Calif., in mid-August. Named as defendants were the Western Precipitation Corp. of Los Angeles, International Precipitation Co. of Los Angeles, Research Corp. of New York and Walter A. Schmidt of Glendale, Calif., president of the two Los Angeles companies. Charges of violation of the Sherman Antitrust Law were based on contentions that five foreign co-conspirator companies agreed to engage in no business in the United States, and that the American companies agreed to refrain from business outside the western hemisphere and United State possessions. Defendants also are accused of depriving other manufacturers of the right to use certain patents and technical information.

NEW ENAMEL PLANT FOR LOS ANGELES AREA

CONSTRUCTION of a new branch plant to produce porcelain enamel frit and synthetic enamel industrial paints will probably be started soon on a recently-acquired site in Los Angeles, according to the Ferro Enamel Corp. of Cleveland, Ohio. Warehousing facilities will be made available for ceramic clays, oxides, chemicals and driers. John A. Rumer will be named Los Angeles manager of the firm.

CONSTRUCTION HALTED AT WILLAMETTE PLANT

CONSTRUCTION of the $2,750,000 government-financed Willamette Valley Wood Chemical Co. plant at Springfield, Ore., has been halted. The plant was to have been the first in the nation to produce alcohol from wood waste. It is presumed that the halt was prompted by WPB switch to peacetime operations.

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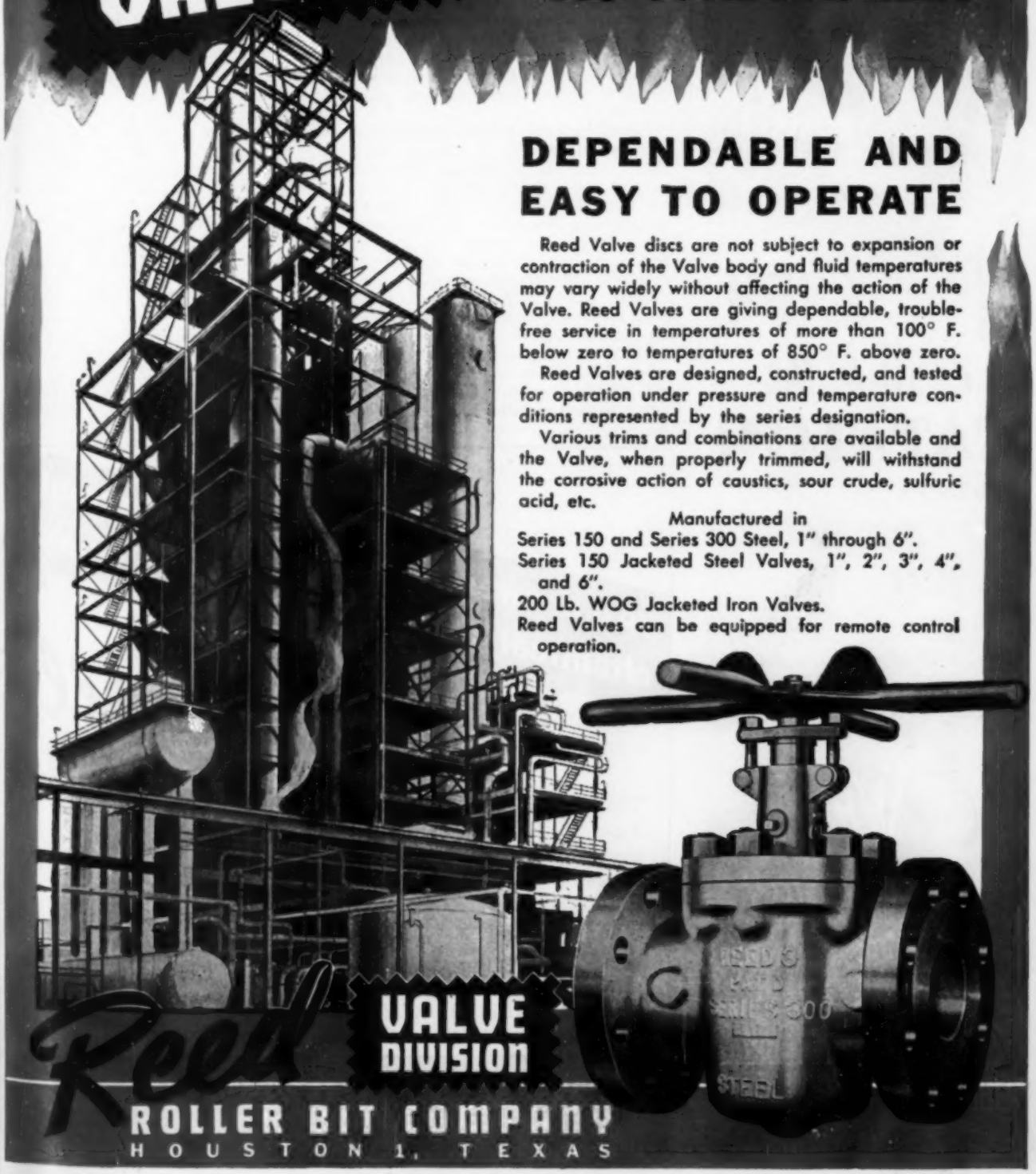

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NEWS FROM ABROAD

COOPERATIVE PLANNING REPLACES WARTIME CONTROLS IN BRITISH CHEMICAL INDUSTRY

Special Correspondence

IT IS TOO early to say how the fortunes of the British chemical industry will be affected by the change of government. The labor administration is pledged to a program of nationalization in certain key sectors of Britain's economy, but the chemical trades are not among these. While the new government may emphasize control where another administration might have put the accent on private enterprise, its economic policy will be determined largely by the facts and circumstances facing the country whatever party is in power.

Nevertheless the process of de-control continues, though on a selective basis. Here are some changes effected: silicon can now be bought without license; aluminum and magnesium permits are given without restriction as to use or quantity; some types of mica are exempt from control; chromium and chromium compounds, magnesite and refractory materials can be sold and bought freely, though still under import control; copper and zinc producers can deal directly with foreign buyers; small lots of non-ferrous metals may be exported by private dealers. While controls are thus gradually lifted, controllers return to their peacetime post. Most important for the chemical industry, Davidson Pratt has gone back as director to the Association of British Chemical Manufacturers, after five years spent in the government's service.

De-control, however, does not mean the end of cooperation. After the trade associations formed during the war to safeguard the interests of specific industries, another class of cooperative enterprise is now in fashion—disposals associations for the orderly distribution of surplus stocks held by government agencies. The Pharmaceutical and Allied Chemicals Disposals Association is a typical example of this new type of enterprise. It has been formed by ten firms to "coordinate and regulate their activities with regard to the disposal of goods obtained by the Association or its members under the direction of the Ministry of Supply and to purchase, control the sale of, and distribute under the Ministry's direction any surplus, second-hand, reconditioned or salvaged pharmaceutical or allied chemicals". Needless to say, all interested and efficient firms participate in these government-supervised disposals associations.

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2° refined **Pyridine**

Now free from allocation

Pyridine, heretofore available only through allocation under WPB Order M-300, and therefore unobtainable for some industrial uses, is now available in pure form, or blended with other tar bases as specified. Other bases regularly produced include Refined Alpha Picoline, Denaturing Grade Pyridine, Refined Mixed Picolines, Refined 2,4 Lutidine, Refined Quinoline, Refined Isoquinoline, and High Boiling Tar Bases. These are chemical raw materials for the manufacture of vitamins, medicinals, and waterproofing agents for textiles. They also may be used for solvent and inhibitor purposes.

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

KOPPERS COMPANY, INC., TAR AND CHEMICAL DIVISION, PITTSBURGH 19, PA.

CAN A COMPANY BE PROPERTY POOR?

Many *will be* "property poor" in the relatively near future!

When a company needs money for new types of machinery, for raw materials of peace products, for the re-establishment of a sales force and customer-credit balance—and finds its *liquid* assets inadequate, the result inevitably is the "property poor" dilemma. For such a company must either convert assets to cash by any means, or do nothing and watch opportunities pass to those who *can* seize them.

As investment bankers, we have watched this situation closely and with some concern—and have noticed that more and more corporation executives, alive to the problem and the dangers inherent in it, are taking steps to neutralize it *now*, while there is yet time. Due to our knowledge of this field of finance, and our facilities for the broad distribution of securities, we have been able, in some of these instances, to underwrite and market new issues which supplied the cash that peace may call for.

If you have been uneasy about the impact of taxes or uncertain peacetime developments on your company's capital structure, you are invited to consult one of our partners about the possibility of strengthening it through new financing. Out of our experience and facilities we may be able to provide the means of your company's preparation for conditions just ahead.

VAN ALSTYNE, NOEL & CO.

Members

New York Stock Exchange *New York Curb Exchange*

52 Wall Street, New York (5)

Duties, introduced long ago to protect certain young essential trades but suspended for administrative reasons during the past few years, were re-imposed in July, but many important chemicals have been exempted from K.I.D. The chemical export trade is more lively, especially with the Dominions and eastern markets, but most of continental Europe is not yet open for private trading. Hopes are based on the resumption of free dealings with France and Belgium, but shipping and supply shortages impose close limits on all exports. Where controlled commodities —as, e.g. lead oxide—are now made available for exports, quotas are divided among would-be exporters to spread the limited supply over the largest possible clientele, for a small part of the total export demand only can in present circumstances be met.

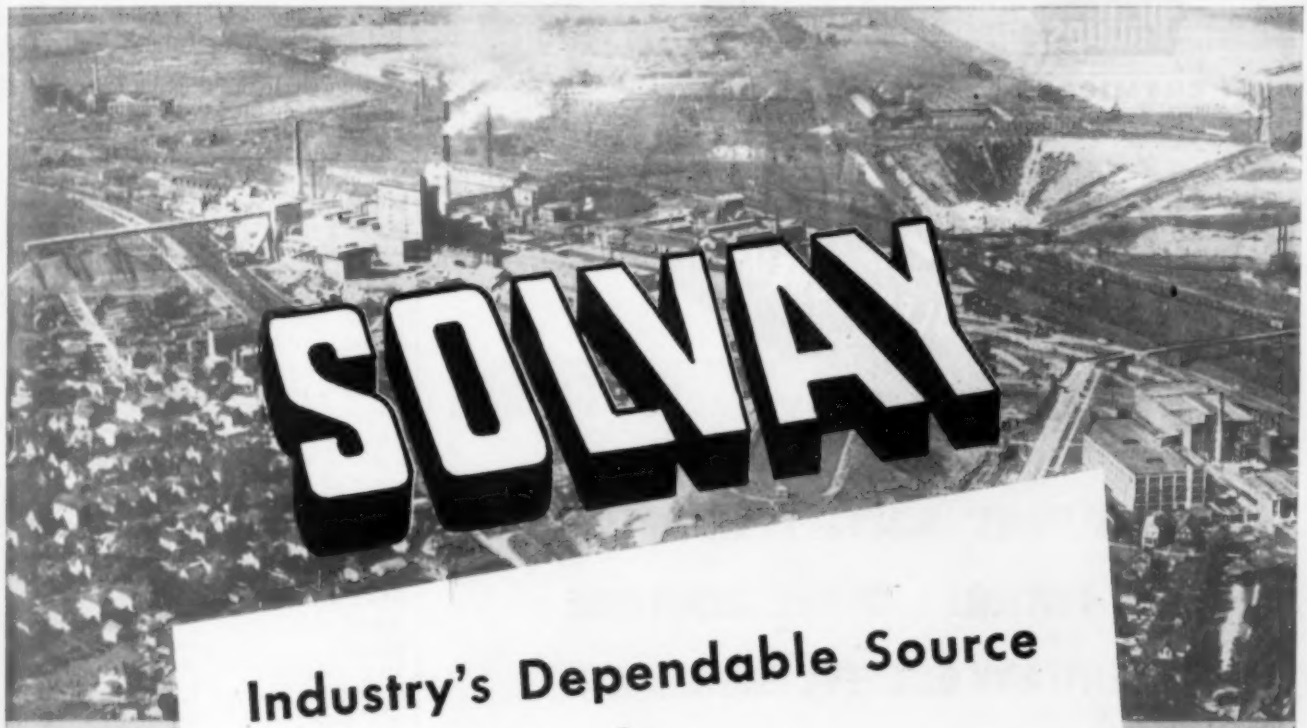
EXPORT DRIVE

Meanwhile preparations for a systematic export drive are going ahead. Old contacts are resumed with overseas representatives and subsidiaries in order to formulate successful export policies. An illustration of present trends is a medium-sized cosmetics and pharmaceuticals producer's plan for the "decentralization of sales and distribution control and in certain cases the performance of packing and finishing processes abroad". Where a particular market offers limited scope, this company hopes to achieve the necessary degree of local efficiency by cooperation with other leading firms in the same country. This announcement would certainly not have been made if other cosmetics manufacturers did not entertain similar ideas. Systematic and planned export development is certainly very much in the news.

Chemical manufacturers are greatly interested in another feature of industrial development springing from the same roots of cooperation and planned development, the Trading Estates. Such Trading Estates were set up before the war in areas to which smaller industries were to be attracted. Provision of suitable sites with transport facilities, cheap power, and skilled labor soon made these Estates busy centers of industrial activity. Now seven new Trading Estates are being started, and four Royal Ordnance factories no longer needed for their wartime tasks will be adapted.

The Board of Trade has set up a special section to deal with this new development which will provide employment for about 100,000 people in various parts of the country. The land is bought by the government, but development and management is in the hands of special companies. One of these has over a thousand firms on its waiting lists for factories. For chemical manufacturers these Trading Estates are of particular interest, for not only are they usually situated near important consuming markets, but the vicinity of so many other industries creates a large outlet for industrial chemicals while some of the wartime plants now being converted are well laid out for chemical production. Before the war these Trading Estates contained already some of the most progressive smaller factories for plastics, cosmetics and similar small-scale manufactures.

Among chemical bulk industries ex-



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TERTIARY BUTYL MERCAPTAN

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TERTIARY DODECYL MERCAPTAN

Yes, there IS something new under the sun. These new petroleum chemicals, never before made in volume, have properties which are sure to lead to a wide variety of industrial applications. They are manufactured in tank car quantities. Six more Phillips sulfur chemicals listed below are available now in drum quantities.

TERTIARY AMYL MERCAPTAN
TERTIARY HEXYL MERCAPTAN
TERTIARY HEPTYL MERCAPTAN
TERTIARY OCTYL MERCAPTAN
TERTIARY TETRADECYL MERCAPTAN
TERTIARY HEXADECYL MERCAPTAN

NOTE

We'll gladly mail you a copy of bulletin #118, listing physical properties, typical reactions, and suggested uses of these compounds. Experimental sample requests on company letterhead will receive prompt attention.

PHILLIPS PETROLEUM COMPANY

Special Products Division

BRANCH 2 BARTLESVILLE OKLAHOMA

pected to provide larger tonnages for the British market is the fertilizer trade. The leading firms have been requested by the government to make plans for considerable expansion since the large-scale imports of lend-lease fertilizers from the United States will soon cease. Even then British agriculture will have to rely on imported potash and phosphates, though the supply of phosphoric materials is likely to increase as a result of the construction of new superphosphate factories and blast furnaces; the latter will add considerably to the basic slag supply. Some of the leading fertilizer companies have submitted proposals for major extensions.

This is just another example of growing cooperation between industry and authorities and among industrial firms another instance of which is mentioned in the annual report of the Boots Pure Drug Co. This company, the biggest retail distributor of chemicals and a big producer of various products, refers to the help received from two other pharmaceutical manufacturers when its factories were blitzed; the firm helped others when they were damaged. Boots' output on behalf of such other firms included 9,000,000 tablets of soap, 6,500,000 pills, and 1,000,000 blocks of solid dentifrice. This mutual aid, given and accepted as a matter of course during the war, has mellowed down the old spirit of trade rivalry and competition.

Firms which have had to surrender their individuality in the interest of cooperation in nucleus establishments, trade associations, research institutes, surplus disposal companies, which have had to accept government advice and guidance on every important aspect of production and distribution, are only too eager to regain some of the lost initiative and freedom, but they have also come to realize the advantages accruing from coordination of individual efforts.

It is expected that the huge demands for building materials (including paints, plastics and other chemicals) will be supplied centrally by a public agency under government control which would be able to distribute work among all factories and thus to ensure full use of all production facilities. This, of course, will mean more pooling of production facilities, more sharing of research discoveries, more cooperation and subordination of private interests to centralized guidance and direction.

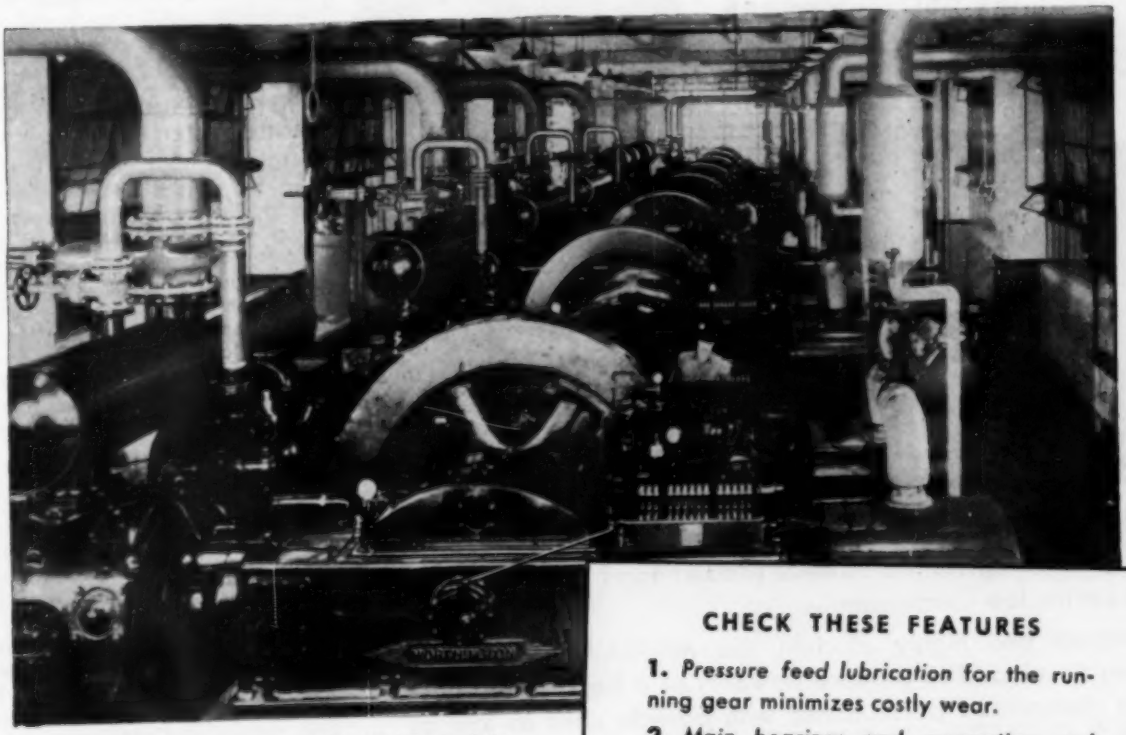
SWITZERLAND GETS POTASH FROM ALSACE MINES

Resumption of shipments of potash from Alsace is indicated by reports which come from Switzerland. According to the Swiss press, two shipments amounting to 400 to 500 metric tons each arrived in Switzerland some weeks ago. With rail traffic on the increase the Swiss Federal Railways have sent numerous cars to the Alsatian potash region to transport potash to Switzerland.

FRENCH MOROCCO TRADE IN PHOSPHATE ROCK

Exports of phosphate rock from French Morocco increased substantially last year. In 1943 exports were 892,000 metric tons and in 1944 they moved up to 1,371,000

HOW TO GET LOW COST AIR FROM "NO" COST STEAM POWER



Battery of Worthington OXP Opposed Steam Driven Compressors in a large processing plant.

. . . *with minimum outage for adjustment*

In hundreds of plants where large quantities of exhaust steam are needed for heat exchangers and processing, Worthington Opposed Steam Driven Compressors with exclusive Feather* Valves are lowering air costs two ways. Because the steam drive on the compressor serves as a reducing valve on the process steam line, *power cost is negligible* . . . and because the composite effect of four Worthington features assures continuous heavy-duty service, *maintenance costs and outage time are kept at a minimum.*

*Reg. U. S. Pat. Off.

CHECK THESE FEATURES

1. *Pressure feed lubrication* for the running gear minimizes costly wear.

2. *Main bearings and connecting rod bearings are especially designed for pressure feed lubrication.* No troublesome, adjustable wedges...no weaving, no breathing of bearings.

3. *Operates on steam pressures as high as 450 p.s.i.* and corresponding high steam temperatures. Back pressures up to 200 pounds if desired.

These and other features that add up to low maintenance cost, high operating economy, freedom from operators' Sunday work prove that *there's more worth in Worthington.*

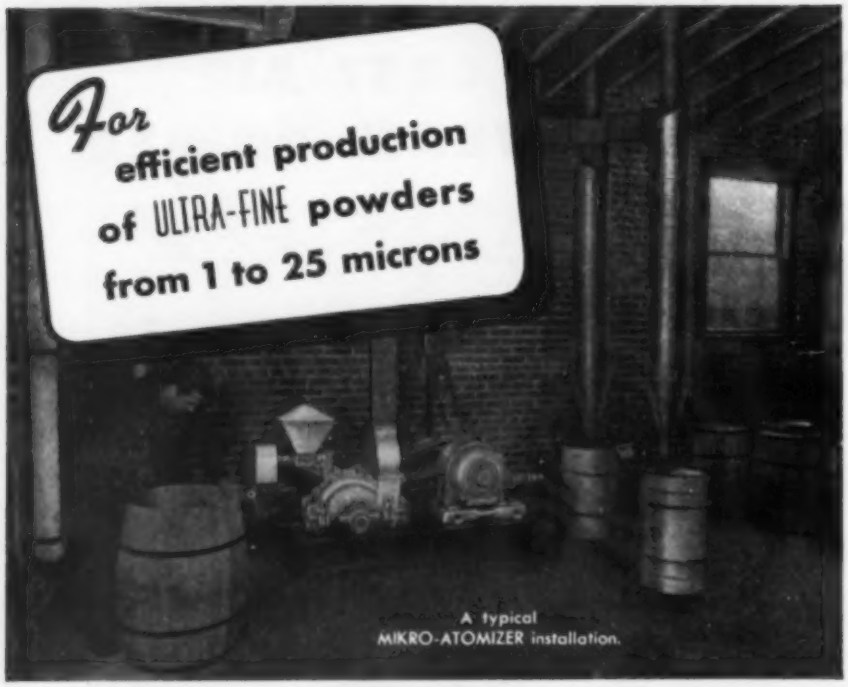
Write for literature . . . Publication Dept., Harrison, N. J. *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.*

WORTHINGTON

K8-42

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

Y-types | Vertical | Horizontal | Portable | Radial | Gas-Engine Compressors



A typical MIKRO-ATOMIZER installation.

THE new MIKRO-ATOMIZER provides mechanical, screenless pulverizing for the efficient production of ultra-fine powders in the low micron ranges.

Compact and highly efficient, the MIKRO-ATOMIZER has been developed to produce powders of a fineness that permits guaranteed performance with particle sizes as low as 1 to 2 microns on certain materials. In addition, the operation is exceptionally cool.

Dependable mechanical control of particle size is assured with the MIKRO-ATOMIZER. An entirely new principle in grinding is employed involving the imparting of a centrifugal force to each particle and opposing that force with an aerodynamic drag. This principle is applied in combination with and as an integral part of the grinding action.

MIKRO-PULVERIZER
For over 20 years the leader in producing fine grinds of a large variety of materials.

To arrange for a test grind of your material in a MIKRO-ATOMIZER, send for a copy of Confidential Test Grinding Data Sheet and new MIKRO-ATOMIZER Bulletin.

By Invitation Member
WARRANT of QUALITY

PULVERIZING MACHINERY COMPANY
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NOW . . . 2 TYPES TO MEET MOST PROCESS JOBS

MIKRO-PULVERIZER (FINE)
MIKRO-ATOMIZER (ULTRA FINE)
Reg. U. S. Pat. Off.

metric tons but did not reach the 1939 total of 1,509,000 metric tons. Only a small proportion of rock is consumed at home so exports correspond rather closely with production. The industry continues to move ahead as unofficial figures place production in the first quarter of this year at 483,000 metric tons as compared with 394,800 metric tons for the like months of 1944.

UNITED KINGDOM WILL USE MORE NAVAL STORES

In the United Kingdom it is expected that the market for naval stores will be greatly increased in the postwar years to meet the heavy demand from the paint industry resulting from new construction and renovations. The soap and paper industries also are expected to take at least up to their normal quotas. The immediate outlook for turpentine is described as more promising than that for rosin as supplies of turpentine are fairly large even though far below what they were a year ago.

CUBA INCREASES PRODUCTION OF LAUNDRY SOAP

In an effort to produce the largest possible amount of soap from a limited supply of oils and fats, the Cuban Office of Price Regulation and Supply recently ordered all manufacturers to increase substantially the quantity of water-soluble builders in their laundry-soap formulas. Laundry soap accounts for approximately 90 percent of Cuba's soap consumption since it is used for personal as well as household purposes. It is estimated that the new regulation will increase outputs by 40 percent.

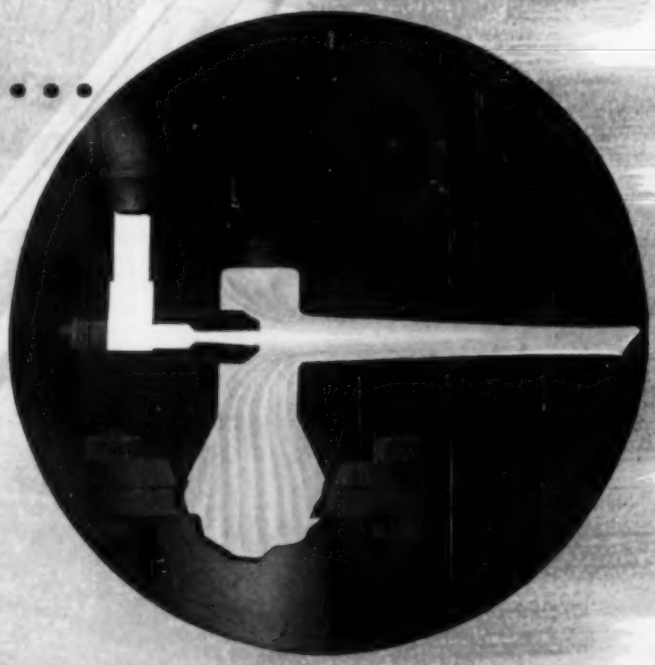
BRAZIL HAS GREATER NEED FOR TECHNICIANS

Increased industrial activity in Brazil has created greater need for technicians and it has been suggested that more young Brazilians be sent to the United States for study and work in laboratories, institutes, and factories. Modernization of Brazil's engineering educational methods based on the system followed in the United States has been recommended by a technical mission of six prominent engineering professors who recently completed a four-month study in this country under the auspices of the Inter-American Development Commission. The chief objective of the mission was to study the engineering instruction system in the United States and its connection with industry; to examine modern laboratories for research and production control; and to visit some of the large United States factories.

CHILEAN TEXTILE MILLS ARE MORE ACTIVE

The Chilean textile industry, in its woolen, cotton, and silk branches, is reported to have been the most active of the country's manufacturing groups during the first quarter of this year. Woolen mills are estimated to have increased production by nearly 20 percent in order to meet the enlarged demand for their products. In connection with attempts to

SK JET PUMPS...



are as *Trouble Proof* as an End-Wrench

• Everyone knows that there is nothing about an end-wrench to get out of order. It is a simple, functional tool designed for efficient service.

SK Jet Pumps have much in common with the end-wrench. They have no moving parts and there is nothing about them to get out of order . . . no glands to adjust or replace, no bearings, no rotating or reciprocating parts to wear. They lift or transfer liquids or solids, produce vacuum or pressure, condense vapors, mix gases, heat and agitate liquids . . . perform many functions with a simplicity which assures continuous, trouble-free operation.

Can SK Jet Pumps be used to solve your pumping problems, improve your process operations, reduce your costs? The research and engineering organizations of Schutte & Koerting are available for consultation on your specific problems. Since 1876 they have pioneered the development and application of jet pumps of all types, from the simple single-stage aspirator to the highly developed multi-stage jets for extreme vacuum.

STEAM JET	LIQUID JET	AIR JET
Agitators	Agitators	Agitators
Compressors	Condensers	Compressors
Ejectors	Compressors	Ejectors
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. . . both SINGLE- and MULTI-STAGE.

Write today for Condensed Catalog J-3 which outlines many industrial applications of the jet principle.

SCHUTTE & KOERTING COMPANY

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1190 Thompson Street

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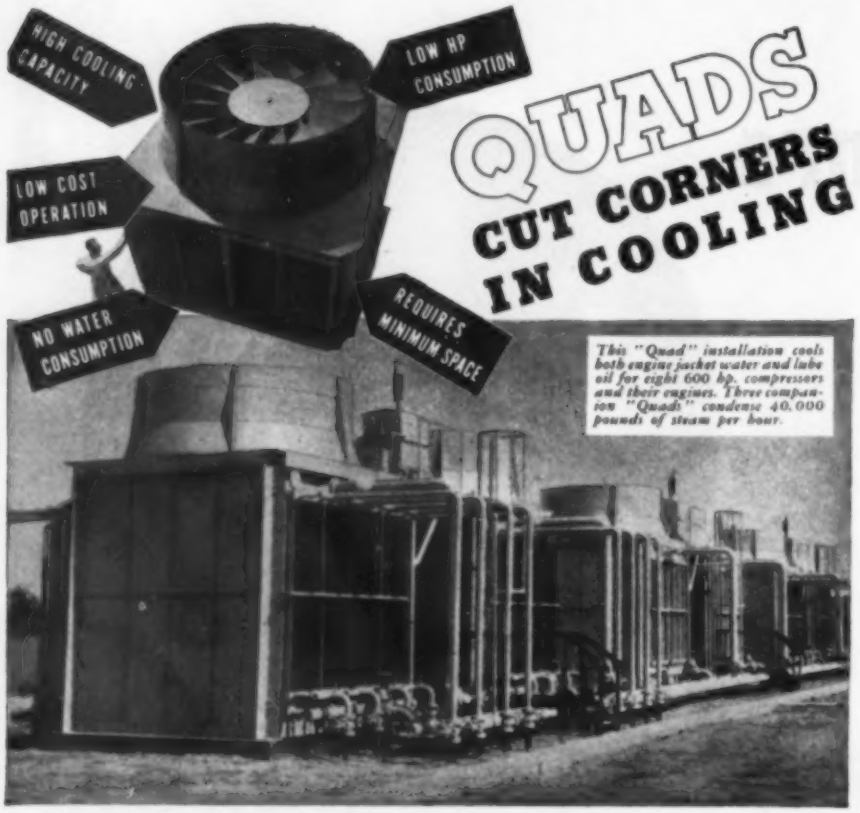
HIGH COOLING CAPACITY
LOW HP CONSUMPTION
LOW COST OPERATION
NO WATER CONSUMPTION
REQUIRES MINIMUM SPACE
QUADS
CUT CORNERS IN COOLING
This "Quad" installation cools both engine jacket water and lube oil for eight 600 hp. compressors and their engines. Three companion "Quads" condense 40,000 pounds of steam per hour.

In pioneering the "Quad" (closed cooling system) radiator type cooler and condenser, Young engineers achieved a higher degree of cooling efficiency with lower operating cost. "Quads" have a large capacity and are ideal for installation where requirements are multiple and varied. The vertical exhaust, combined with four sides of cooling, eliminates air re-circulation and the retarding effects of cross-wind currents. All four sides are available for cooling surface. Batteries of Young "Quads" are becoming a familiar sight wherever large or multiple cooling and condensing problems are involved. Let Young engineers supply further data and details without obligation.

YOUNG

HEAT TRANSFER PRODUCTS

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Oil Coolers • Gas, Gasoline, Diesel Engine Cooling Radiators • Intercoolers • Heat Exchangers • Engine Jacket Water Coolers • Unit Heaters • Convectors • Condensers • Evaporators • Air Conditioning Units • Heating Coils • Cooling Coils • and a Complete Line of Aircraft Heat Transfer Equipment.

YOUNG RADIATOR CO., Dept. 455-J RACINE, WISCONSIN, U. S. A.

Distributors: The Happy Co., Drawer 770, Tulsa 1, Okla.—A. R. Flournoy Co., 609 S. Grand Ave., Los Angeles 14, Calif.—Wrightson-Campion, New York, N. Y.—W. P. Nevins Co., Chicago, Ill.—C. H. Bull, San Francisco, Calif.—EXPORT: Amoresco, Inc., New York, N. Y.

increase the industrialization of Chile, textile manufacture is included in plans being made by a government organization looking toward the acquisition of machinery to improve and modernize existing production facilities.

NEW-TYPE WHALING SHIP LAUNCHED IN ENGLAND

THE first of three large whaling factory ships under construction at the Furness Shipbuilding Co., Ltd. at Haverton Hill, England, was launched early in June. The vessel is one of the largest ever constructed for the carriage of oil. Its nine cargo compartments have a total capacity of about 19,150 tons. It was specially designed and is a high class example of the modern tanker with the addition of a shelter between decks 22 feet high to accommodate the whaling factory equipment. The vessel will act as a parent ship to a number of small steam-driven high speed whale catchers.

AUSTRALIAN COMPANY WILL PRODUCE TITANIUM

According to press reports, production of pigments will be extended in Australia by the addition of a plant which will be established in Tasmania. The British Titan Products Co., Ltd., has purchased a site near Burnie on which a plant will be erected for making titanium for the Australian trade.

INDIA HAS FOUR MAGNESIUM CHORIDE PLANTS

MAGNESIUM chloride is used in India principally as a sizing agent in textile mills and prewar consumption averaged between 7,000 and 8,000 tons. Four plants are now producing this chemical in India, at Mithapur, in Kathiawara, at Khuda in Dhrangadhra State, and at Kharaghoda. At the Kharaghoda works the material is recovered from the residual liquors from salt production.

LARGE SUNFLOWER SEED CROP IN ARGENTINA

HARVESTING of the sunflower seed crop, recently completed in the Argentine, indicates an unusually large outturn. The first official estimate to the U. S. Office of Foreign Agricultural Relations places the yield at 1,263,000 short tons. However, Argentine trade estimates set the figure at between 1,000,000 and 1,150,000 short tons which would be about equal to the record production of 1944. Trade estimates estimate the exportable surplus of oil from the 1945 crop at 135,000 to 165,000 short tons.

PAINT-MAKING EQUIPMENT WANTED IN PERU

THERE is reported to be an excellent demand for United States paint-making equipment in Peru. Fourteen factories are in operation and eight of them have either placed orders or expressed a desire to do so. Preferences by types include ball mills, roller mills, crushing and grinding machinery as well as mixing tanks, varnish kettles and similar equipment.

DESIGNED FOR

hydraulic control

Hydraulics have proved ability to control machine operations—with pressures in pounds or tons, with high precision and high speeds—

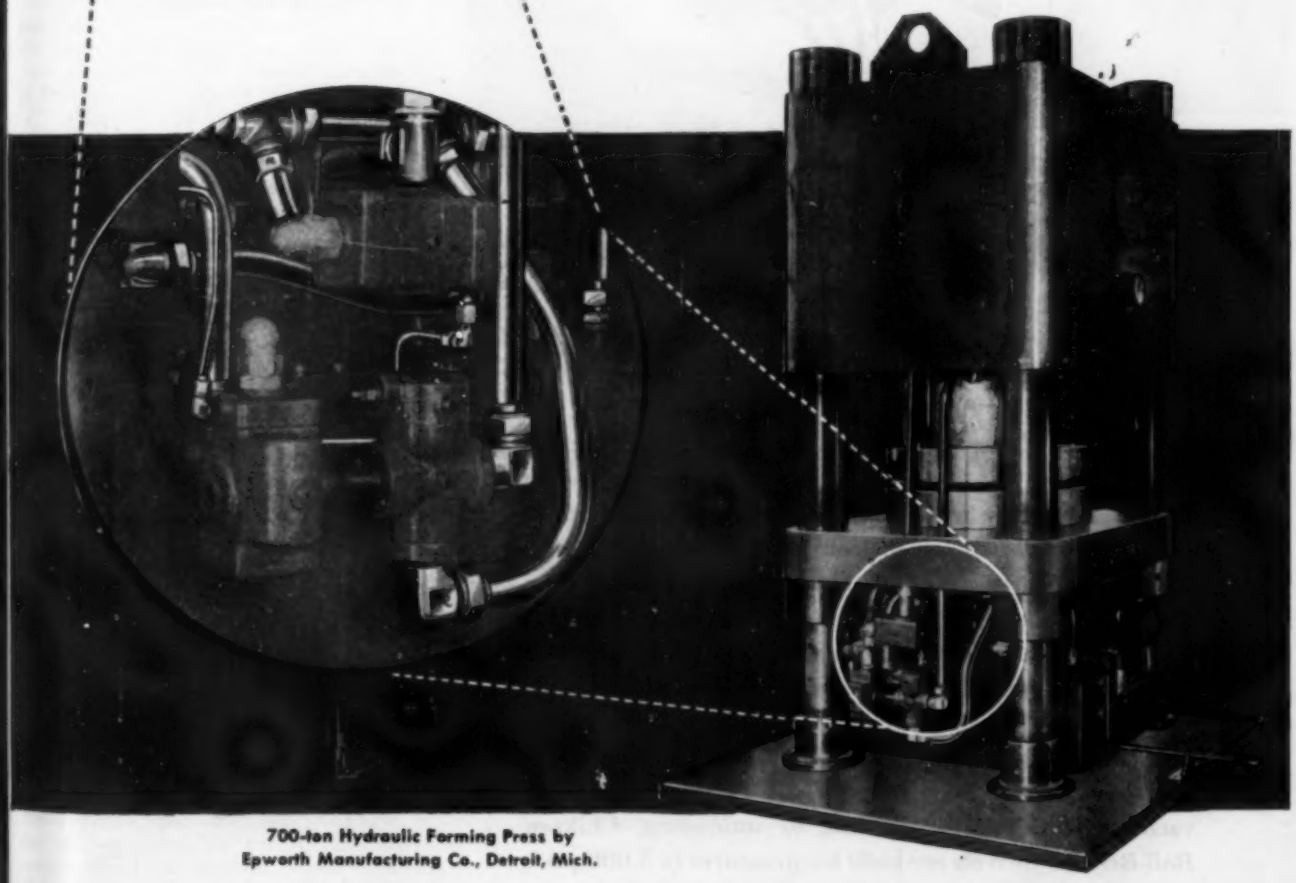
There is only one "if"—the system of tubing, fittings and valves must be properly engineered. Here at Parker we call that job Fluid Power Engineering, and we've been at it for 20 years, on aircraft, motor vehicles, machine tools, refrigeration and process equipment.

A soundly engineered Fluid Power System will have these characteristics:

- It will have streamline flow, to minimize capacity and lessen pressure requirements on the power source.
- It will be compactly designed, to save space.
- All parts will be accessible, for easy and quick service and maintenance.
- It will have the minimum number of joints and connections, to guard against leaks, even under conditions of high pressure, vibration shock, fluid hammer and surge, or accidental abuse.

For the design of such a system, and for the valves, fittings and fabricated parts, or for a simple fluid transmission system, call upon Parker experience.

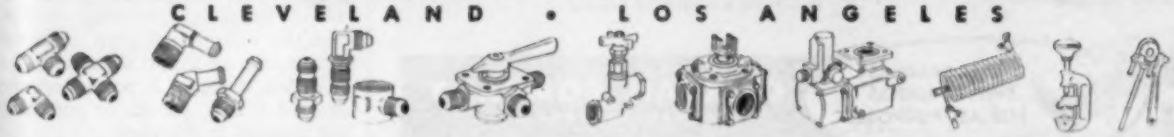
For your present uses, or for new applications to come, talk with a Parker Engineer, especially in the planning stage. You'll save money, and be more certain of satisfactory results. Write to The Parker Appliance Co., 17325 Euclid Avenue, Cleveland 12, Ohio.



700-ton Hydraulic Forming Press by Epworth Manufacturing Co., Detroit, Mich.

THE PARKER APPLIANCE CO.

CLEVELAND • LOS ANGELES



FLUID POWER PRODUCTS FOR ALL INDUSTRY

BB_2 = Double rows of Ball Bearings
EP = Effective Packing Element
P/V = Pressure or Vacuum
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Perfect flexibility with low torque is assured in every CHIKSAN *Ball-Bearing* Swivel. Yet Chiksan design and construction are so sound they can be expressed in a simple formula. There is nothing to tighten or adjust . . . no stuffing boxes to put the brakes on easy turning and thus produce excessive strains on pipe lines and fittings. Smooth, easy turning throughout 360° is provided in one, two and three planes. Packing Element is so effective the same Swivel may be used for either pressure or vacuum service . . . for loading or unloading. Chiksan *Ball-Bearing* Swivels are built for pressures to 3,000 p.s.i. and varying temperatures. Write for latest catalog.

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CHIKSAN TRADE MARK REG.
BALL BEARING SWIVEL JOINTS FOR ALL PURPOSES
CHIKSAN COMPANY
BREA, CALIFORNIA

GERMAN INDUSTRY

(*Continued from page 115*)

gen was not available at Leuna for all purposes so increased gas manufacturing equipment was installed. A part of this equipment consisted of a continuous Winkler generator utilizing brown-coal coke and cheap oxygen from Linde-Frankl units. One large generator was said to have sufficient hydrogen capacity for production of 300 tons of ammonia per day. Ammonia capacity was increased by 50 percent at Oppau and a new plant for 100,000 tons ammonia per year was constructed at Hydebreck. At the same time, an increase of ammonia capacity at some of the Ruhr plants was undertaken.

No significant amount of ammonia was obtained either from Hydebreck or new Ruhr installations but full advantage of the Oppau increase was realized. New synthetic fuel plants were installed at a number of locations. The result of this whole program was that practical synthetic ammonia capacity at the end of the war was perhaps somewhat less than before the war and production of synthetic fuels by hydrogenation of tars, coal, and from carbon monoxide and hydrogen was increased some fivefold during the war. In general, the Bergius process proved to be preferred to the Fischer-Tropsch.

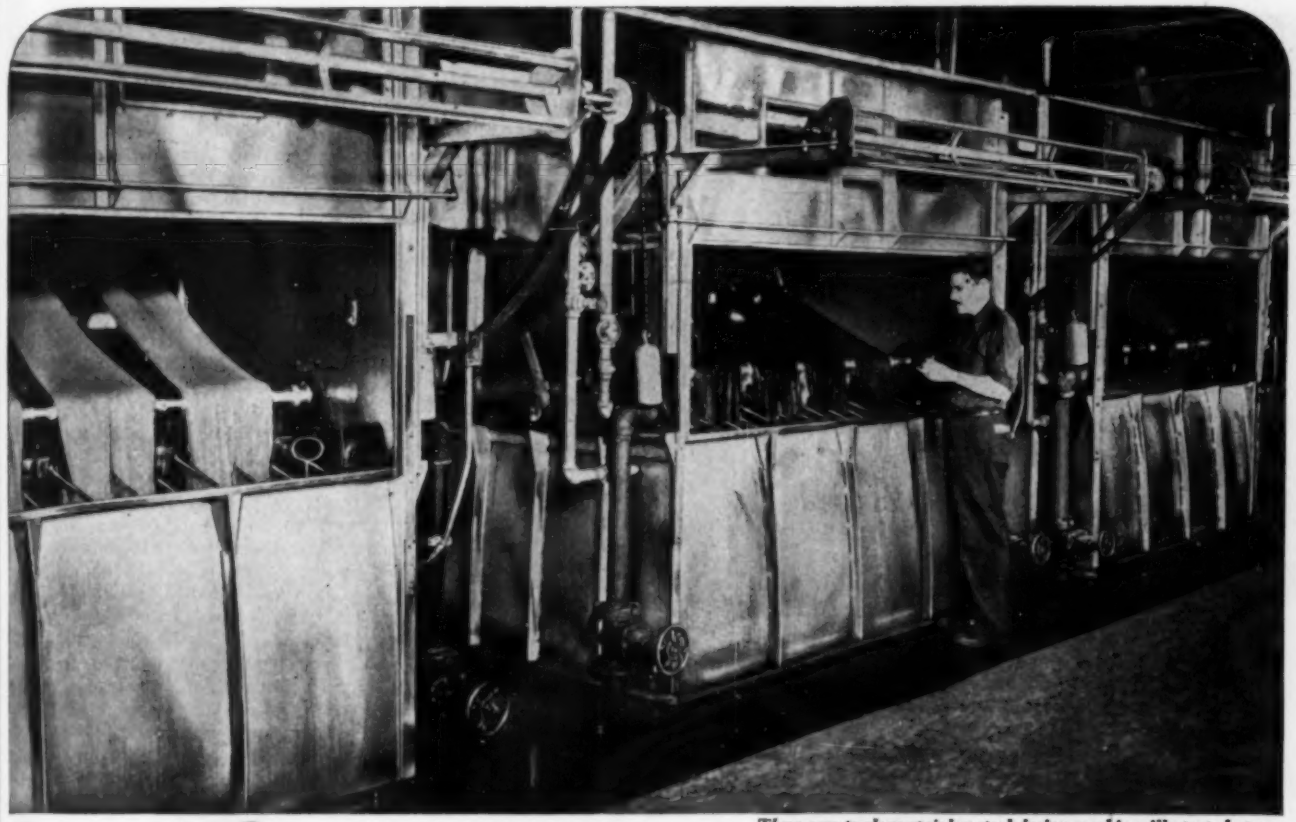
Other developments in chemicals from water, air and coal include lubricating oils by ethylene polymerization, toluene from benzene and methanol and alkyl benzenes from higher alcohols. A satisfactory stock for soap substitutes and synthetic fats was produced as a byproduct. The Germans appear to have made little or no advance in ammonia synthesis technology except in hydrogen manufacture as noted above.

2. ACETYLENE PRODUCTION AND UTILIZATION

Because of the lack of short-chain hydrocarbons obtainable by cracking petroleum, acetylene occupied a position of abnormal importance in German chemical industry and research. A large number of products and processes were developed to relieve shortages or for lack of an alternative route to the desired material. Acetylene was definitely one of the most important raw materials of the German war economy.

While most acetylene was still made by the calcium carbide route, one large plant, at Hüls, was in successful operation using the arc process. The raw material was waste gas from coal hydrogenation, natural gas, or coke-oven gas residues after passing through the Linde process. Its success was due largely to the discovery that acetylene can be safely handled under pressure by observing certain precautions, and that water can be used as the recovery solvent by taking advantage of the fact that the pressure solubility characteristics of acetylene are almost identical with those of carbon dioxide. A power consumption of 4.3-4.8 kwh. per lb. of pure acetylene was attained at this plant.

While many of the reactions employed



These easy-to-clean stainless steel dyeing machines illustrate but one of many applications for lustrous Republic ENDURO in the textile industries. Others include: dry cans, tables, valves, reels, hosiery forms and bleaching equipment.

Enduro Pays in many ways

- Improved Employee Relations
- Easy to Clean
- Assures "True" Colors
- Strong—Long Lasting
- Resistant to Rust and Corrosion
- Easy to Fabricate
- Universal Acceptance
- Low Ultimate Cost

Lustrous, bright, sanitary appearance—plus factor of Republic ENDURO Stainless Steel—pays prompt dividends in improved employee relations.

ENDURO is clean—and remarkably easy to clean. It makes work easier. Employees take pride in keeping it spotless. They find new incentive in the bright, cheerful atmosphere created by gleaming ENDURO equipment. And its smooth, shiny surface never wears out because ENDURO is solid stainless steel all the way through.

There are many other reasons, too, why it will pay you to specify ENDURO Stainless Steel. See your equipment manufacturer or write directly to:

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES: CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

Republic
ENDURO STAINLESS STEEL
Reg. U. S. Pat. Off.

Other Republic Products include Carbon and Allo[illegible]

had been disclosed in patents and other literature, the extent to which their use had developed is of distinct interest. Butadiene, for example, was made from acetylene, either via the acetaldehyde-aldol route, or via the formaldehyde-acetylene (butinediol) route to conserve acetylene. Even ethylene and ethyl alcohol were made from acetylene, and synthetic lubricating oil was produced by polymerizing the ethylene.

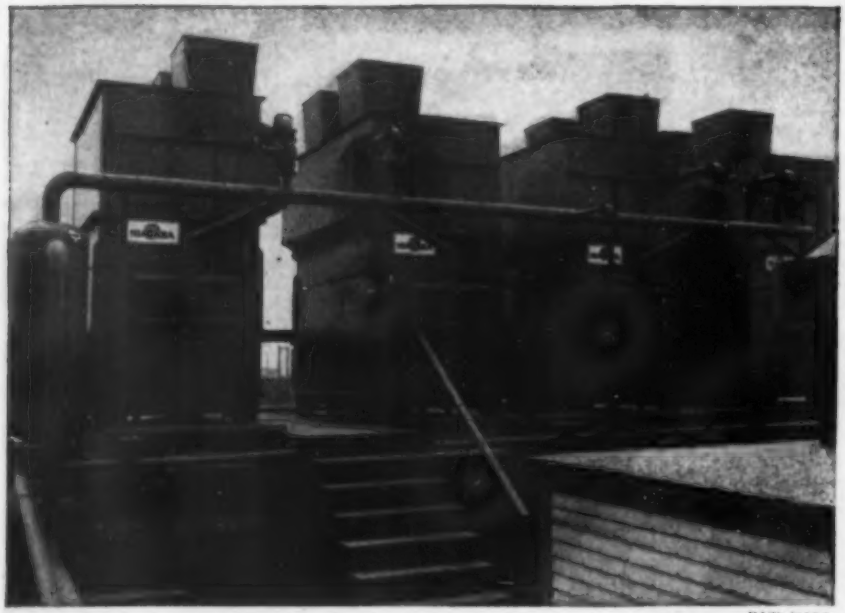
By working out safe conditions for handling acetylene under pressure, the I. G. Farbenindustrie freed the chemistry of acetylene from the limitations imposed by its inherent hazards and was able to raise the vinylation reaction to a status comparable to sulphonation or nitration, working without accidents at pressures up to 20 atmospheres and temperatures up to 200 deg. C. The alkali alcoholate catalysts disclosed in I. G. patents were used to make vinyl ethers of the alcohols containing up to 18 carbon atoms, the products being then converted into polymers for use in various fields, including textile assistants and sizes, adhesives, wood and fiber impregnants, pour point depressants and plasticizers. This type of catalyst also served to produce vinyl amines, such as vinyl carbazole, and could, in general, be used for the vinylation of any organic compound containing active hydrogen. For making ring substituted phenols, the catalyst used was a zinc (or cadmium) salt of an organic acid. By this procedure the tackifier the buna vinyl isobutyl phenol (Koresin), was produced.

A third catalyst of major importance was copper (or silver) acetylide. By proper preparation on a support and by proper control of operating conditions, this temperamental compound was brought under safe control. Using this catalyst, the triple bond of acetylene remains and addition takes place at one or both carbon atoms. With alkylolamines, propargylamines were obtained; with vinylamines, aminobutines (which can readily be rearranged to butadienes); and with aldehydes or ketones, acetylenic alcohols or glycols were formed. Butinediol, from acetylene and formaldehyde, was converted to tetrahydrofuran and thence to butadiene, thus substituting methanol for part of the acetylene normally required.

A fourth catalyst recently found was nickel carbonyl, which could be used to introduce the CO group into the molecule. Thus, acrylic acid could be produced from acetylene, water and CO, or starting with alcohol instead of water, ethyl acrylate was manufactured. Using the same catalyst, CO was added to tetrahydrofuran to give adipic acid.

By using a modification of the copper acetylide catalyst (addition of alkali chloride) in aqueous hydrochloric acid solution, acrylonitrile was produced on a large scale by the direct addition of hydrocyanic acid to acetylene. With mercuric chloride catalyst, vinyl chloride was produced and with zinc acetate, vinyl acetate.

Other important compounds starting from acetylene, some of which involved quite complex syntheses, include the following: glycerine, tetrahydrofuran, adipic acid, 5-amino caproic acid, 3-butyro



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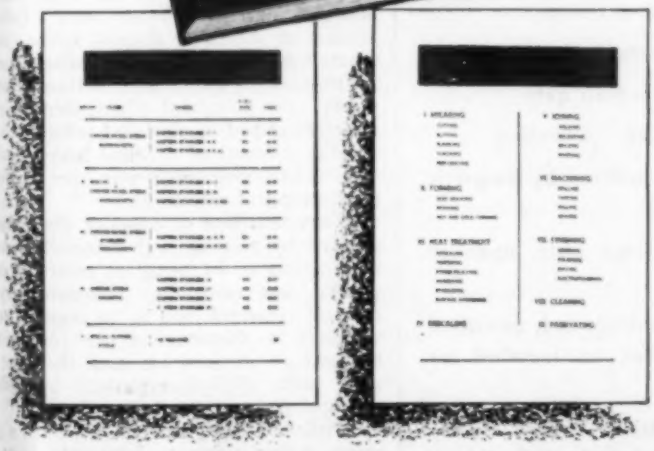

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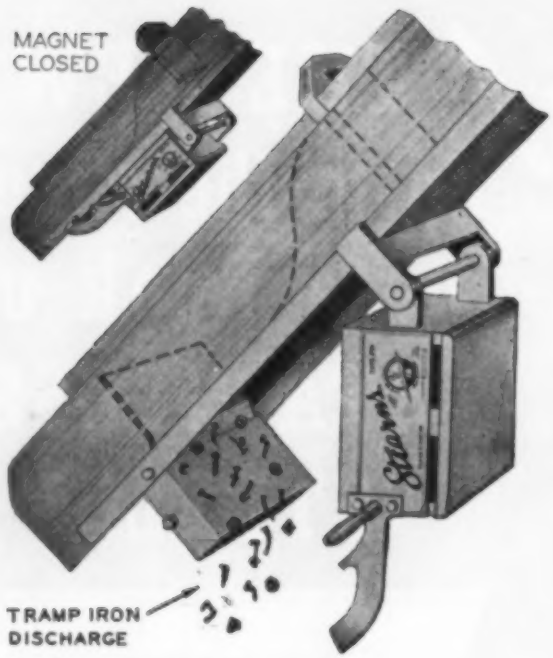

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3. SURFACE ACTIVE CHEMICALS

One of the most important discoveries made was the fact that the addition of cellulose glycollic acid sodium salt to synthetic detergents increases their effectiveness to fully the equivalent of that of soap. The amount required was about 25 percent of the amount of synthetic detergent.

The production of synthetic detergents was greatly expanded, reaching 75,000,000 lb. per. yr. Besides the I. G. types, the Igepons and Igepals, the two synthetic American types, alkyl benzene sulfonates and aliphatic sulfonates, were produced in large quantities. The fatty-acid and consequent soap shortage was largely relieved by substituting the synthetics or incorporating them in the soaps made of necessity from synthetic fatty acids.

The older emulsifying agents were of the long chain aryl polyglycol ether type. Later there was introduced the Emulphor STH and STX type, made by condensing a long chain aliphatic sulfone chloride (Mersol) with ammonia and then with chloroacetic acid. This was favored for drawing oil emulsions as it conferred extreme pressure lubricant properties and gave very smooth surfaces while at the same time possessed anti-rust characteristics. Later because of shortages, dodecyl xylene sulfonate was also sold under the same name.

Demulsifying agents were of three types —alkyl aryl polyglycol ethers, derivatives (amides) of hydroxyoleic acid sulfate ester, and the sulfonate of di-(ethyl hexyl) maleate. These were each very specific for certain types of petroleum.

Water resistance of cellulosic fibers was attained by treating with hexamethylene di-isocyanate or by using an emulsion of paraffin wax containing zirconium oxychloride (Persistol, said to be resistant to washing) or aluminum acetate (not fast to washing). A claim was made that treatment with di-(hydroxymethyl) phenols produced permanent water repellance.

Textile-finishing materials, wetting agents dyeing assistants, lubricants, printing assistants, and levelling agents, were marketed in large numbers. Most of these were based on combinations of the Igepon —Igepal—Alipals or a composition containing selected vinyl ethers. By suitable combinations of these ingredients and natural or synthetic oils most of the various members of the wide range of textile assistants were produced.

4. TANNING AGENTS

An interesting group of synthetic tanning agents known as Tanigans had been developed by the Germans.

Tanigan A was produced by condensing together 4:4' dioxylydiphenyl sulfone, the

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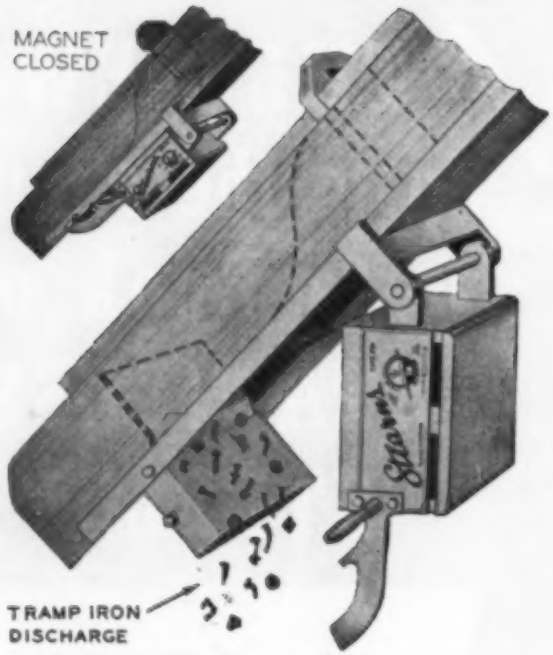

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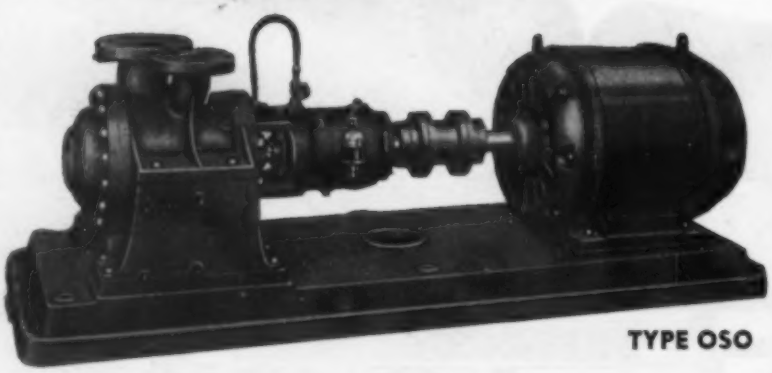

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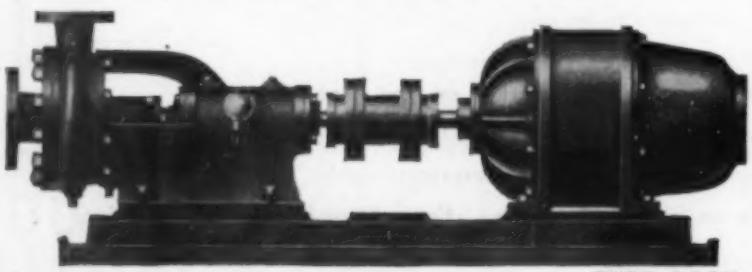

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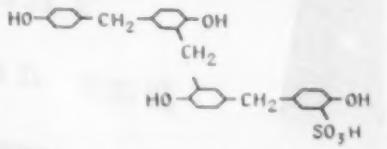
alkaline waste liquors from cellulose treating plants and formaldehyde. A complicated resin resulted which in solution formed a good tanning bath.

Tanigan Extra B was produced by condensing phenol with formaldehyde in the presence of sulphuric acid to form 4:4' dihydroxy diphenyl methane. This was partially sulfonated and the sulfonated material condensed with further quantities of formaldehyde to form:



Tanigan Extra E was a mixture of Tanigan Extra B and the product formed by condensing 4:4' dihydroxy diphenyl methane with the alkaline waste liquors from cellulose treating.

All these materials were claimed to have excellent tanning properties.

5. POLYMERS

For convenience it was considered advisable to subdivide polymers into three parts—plastics, elastomers and fibers.

Plastics—Nearly all of the new developments in plastics were expansions of polymers at least known before the war. An example of a new field of polymers was the polyvinyl pyrrolidones made from gamma butyrolactone, ammonia and acetylene. This field was still very much in the embryonic stage. The uses of these polymers, which in some ways physically resemble albumen, may not parallel those of the older plastics as is evident from their employment in the blood substitute, Periston.

A class known before the war but which has undergone great development is that of the polyurethanes produced by the reaction of di-isocyanates with polyalcohols. Linear polymers, such as Igamid U, produced from 1,6-hexamethylene di-isocyanate and 1,4-butanediol, can be both injection and compression molded. The products have good mechanical strength and electrical properties and very low water absorption. Fibers and bristles can be made by hot melt spinning and stretching, and leather substitutes, by sheeting. Other linear polymers furnish plywood adhesives more elastic than phenolics. When alcohols with more than two functional groups were used, infusible polymers were produced which make coatings of great weather resistance and very impervious to gases.

As might be expected from the fact that acetylene had become the building block for so much of the German aliphatic chemical industry, the vinyl plastics were greatly expanded. Polyvinyl acetate and the polyacrylates were running a race, with cheapness favoring the former and quality the latter. A new and cheap process of producing acrylic acid in one step from acetylene promised to intensify the competition. In general, all methods of polymerization, mass, solvent, emulsion and suspension, were in use and not only were many different types of products made depending on conditions of polymerization, but the possibilities of copolymers were fully utilized. The vinyl polymers were used for surface coatings, glues, paints, food

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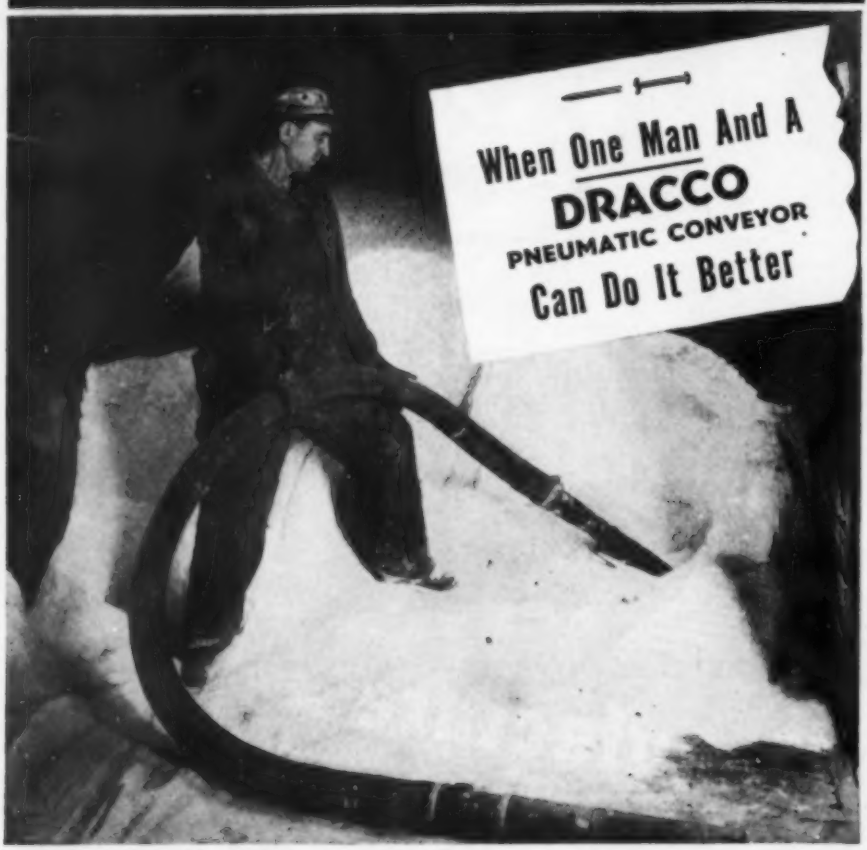

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Unplasticized polyvinyl chloride stabilized with phenylindol had a large use for molding, sheets, tubes and stretched films. Much of the first three forms was used for chemical equipment and the films were employed for packaging and insulation. Development was under way for continuous calendering machines. The plasticized product was used for wire insulation, fabric coating, shoe soles and fibers.

After-chlorinated polyvinyl chloride does not seem to have made much headway, but copolymers of vinyl chloride and methyl acrylate and particularly of diethyl maleate were growing in importance. Vinyl carbazole and vinyl benzoate were new compounds but both proved of little commercial interest. The great demand for styrene for synthetic rubber slowed its development as a plastic.

There was little new in the phenolic and urea classes of thermosettting resins. In the melamine field, a new type was produced by reacting benzonitrile with dicyandiamide and condensing the resultant product with formaldehyde as usual. Such resins give lacquers with good gloss and better heat stability than the ordinary melamines.

Elastomers—In the field of elastomers Germany has shown little development over American practice; only three products are worthy of mention, namely, buna, polyethlyene and polyisobutylene.

Buna (or synthetic rubber) was produced in a number of grades known as S, SS, SR, etc. Production in general followed conventional lines involving the copolymerization of butadiene and styrene in aqueous emulsion. The lack of fatty acids resulted in the extensive use of a synthetic emulsifying agent (Nekal), only 10 percent of the required emulsifier being used in the form of an alkaline salt of a fatty acid. Potassium persulphate was used as activator and di-isopropyl xanthogenate as a chain modifier. Polymerization was controlled by using phenyl beta naphthylamine and was carried out in a series of six reactors in cascade fashion After recovery of unreacted monomers, coagulation was conducted in two stages using, firstly, a mixture of calcium and sodium chlorides and, secondly, acetic acid. The coagulum passes to a fourdrinier-type paper machine where it is drained, then squeezed between rolls, dried in a four-compartment dryer, and reaches the market in neat, 50-kg. rolls. In spite of the clean appearance and convenient form, German buna S seems to have proved inferior to that produced in the United States.

An interesting tackifier known as Koresin, was developed to aid the adhesion of buna. This proved to be a condensation product of p-isobutyl phenol and acetylene.

Butadiene was produced by a cumbersome synthesis from acetylene:

(1) Calcium carbide→ Acetylene
(2) Acetylene + formaldehyde→ Butinediol
(3) Butinediol→ Butanediol
(4) Butanediol→ Tetrahydrofuran
(5) Tetrahydrofuran→ Butadiene

Tetrahydrofuran is an intermediate produced in the dehydration of butanediol which was not always separated, steps (4)

40

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and (5) being combined. An alternative procedure was to pass from acetylene to acetaldehyde and then to aldol, butylene glycol and butadiene.

Styrene was made conventionally by the dehydrogenation of ethyl benzene which latter was synthesized from ethylene and benzene. Ethylene for this process was produced either from alcohol or acetylene.

There seems to have been very little Perbunan produced in Germany and only relatively small amounts of buna SS and SR. No evidence has been found of commercial production of Neoprene.

Polyethylene (Lupolen) was produced in two grades, one of molecular weight 3,000 with low viscosity and the other of molecular weight 15,000 and high viscosity. Ethylene was polymerized at 2,000 atm. with oxygen as a catalyst to give the high molecular weight material, and in alcoholic solution at 30 atm. with benzoyl peroxide catalyst to give the low molecular weight material. Polyethylene mixed with Oppanol gave a product that could be milled and calendered readily.

Polyisobutylene (Oppanol) was made by mixing isobutylene with ethylene and polymerizing on a belt conveyor using 1 percent boron trifluoride as a catalyst. Temperature was kept below —100 deg. C. by allowing the ethylene to evaporate. The conveyor being totally enclosed, the ethylene was recovered, recompressed and reused. Oppanol, added to the extent of approximately 0.5 percent was used to raise the viscosity of lubricating oils. Although Oppanol alone cannot be vulcanized, mixed with 1 percent of butadiene, or with some unpolymerized isobutylene, it can be vulcanized readily. In this form it found use as a good substitute for electrical cable insulation.

Textile Fibers—The chief development in this line during the war period was the introduction of the polyurethanes as new textile fibers. The most important combination used was hexamethylene di-isocyanate with butanediol 1:4. The polyurethanes were considered equal to nylon in most respects and superior in water absorption and dyeing characteristics. The polyester type was also made, as well as the I. G. polyamide type from 5-aminocaproic acid (ε caprolactam).

Much work was done on the improvement of the process for making cellulose acetate and regenerated cellulose, particularly to reduce usage of acetic acid by employing solvents, and to speed up the viscose cycle. The polyurethane intermediate, hexamethylene di-isocyanate, and other di-isocyanates were also used to produce a surface treated, water-resistant viscose rayon. The cuprammonium process was greatly improved as regards both ammonia and copper recovery, the latter being done cheaply and almost quantitatively, so that in cost this process was considered comparable with the viscose route.

Special acid and chemical resistant fibers were woven of polyvinyl chloride (chlorinated and unchlorinated) and also of polyethylene fibers.

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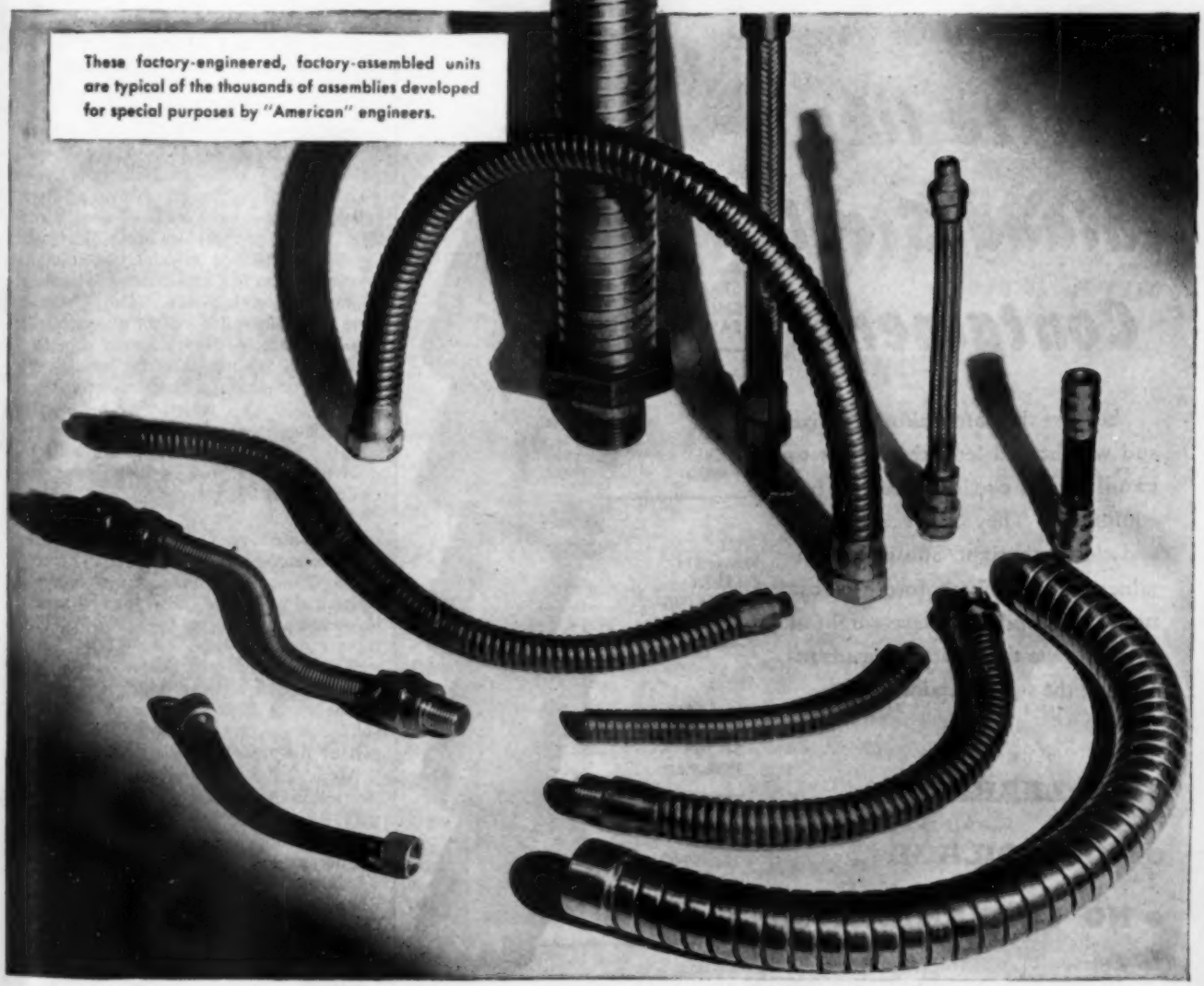

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Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

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"...We like Inland Steel Containers

... because they are uniform in size and weight and lend themselves to handling on ordinary conveying equipment. They are easily filled and closed air tight. Substitute containers we have been forced to use under war conditions have taught us to appreciate the outstanding advantages of the steel container."

No. 5538 STANDARD SHIPPING BARREL

No. 584 LUG COVER PAIL

No. 514X LEVER LOCKING RING PAIL

No. 584R SWIVEL-SPOUT POR-PAIL

No. 594Q CLOSED TOP PAIL

- NO LEAKAGE
- NO SPOILAGE
- NO CONTAMINATION

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Container Specialists

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because bauxite had to be imported from France, Hungary, Greece and Croatia. An experimental plant was operated for the production from clay using sulphuric acid as a first treatment, followed by alkali. The process could be used if no bauxite were available, but was not considered economical. In the conventional process, Soderberg electrodes were used to a considerable extent because of lower cost resulting from baking in the cell. The largest cells used 32,000 amp. Voltages were 4.5-5.0, the current efficiency was 84-88 percent and the power consumption 7.7-8.8 kwh. per lb. of metal. Alloy ingots were cast continuously into chilled molds from 5 in. to 40 in. in diameter and in lengths up to 6 ft.

Germany's magnesium production capacity was increased to about 70,000,000 lb. per year in 1944, compared to an estimated capacity of 35,000,000 lb. in 1939. The main production increase was brought about by duplication of existing equipment, although the latest cells were 50 percent larger than the prewar cells. The cell designs and operating procedures followed published information. The current used was 18,000—32,000 amp. and the efficiency about 88 percent. Power required was 8.0-8.5 kwh. per lb. of metal for electrolysis and about 11.2 kwh. over-all.

The war expansion of the German caustic soda and chlorine industry was in mercury cells, although existing Billeter cell installations were operated as required. The trend to mercury cells increased rapidly in 1937 at which time mercury was very cheap in Germany due to political connections with Spain. The Germans were well satisfied with the mercury cell however, and it did eliminate expensive evaporation equipment. The largest cells under construction at the close of the war were 28,000 amp. which were believed to be the largest capacity chlorine cells in the world. The usual 16.000 amp. cells required 4.5-5.0 v. and had a current efficiency of 94-95 percent.

A new and very interesting vertical rotating mercury cell was used in the most recent plant expansions. This cell required much less floor space than the convential horizontal cells. A trend toward liquefaction of chlorine by means of higher compression followed by water cooling without artificial refrigeration was noted. A new type of rectifier, which was alleged to operate at high efficiency in the lower voltage range, was employed in at least two of the newer installations.

Alkali chlorates were made by the electrolysis of mixed KCl and NaCl in cells with fused magnetite or graphite anodes and iron plate cathodes. The voltage with magnetite anodes was 3.6 and with graphite 3.2, but the graphite consumption was high when used. The electrodes were spaced about 1 in. apart. The current was 10,000-14,000 amp. and the power consumption was 2.8 kwh. d.c. per lb.

Metallic calcium was produced in fused $CaCl_2$ bath cells operating at 25 v. and 1,400 amp., giving 13 kg. per cell per day. Production was 50 tons per month. About 1,500 lb. per month were converted to calcium hydride in tight, electrically-heated retorts.

Potassium permanganate was made by

To Men Who Know Motors

. . . we could end our message here!

To men who know motors, a picture like this is worth the proverbial ten thousand words. It speaks with convincing eloquence of craftsmanship to which any motor builder could point with pride.

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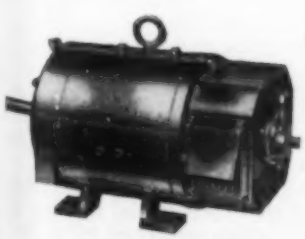
Star not only builds motors well, but also takes leadership in design. Star pioneered ball bearing motors . . . led in welded steel construction . . . developed the famed Star Built-in Magnetic Disc Brake for motors . . . pioneered in the field of gear-motors.

Whether you need special or standard motors, ⅛ to 200 H.P., it will pay to learn why so many critical buyers specify "Star". Some standard motors are ready for early delivery. Star Electric Motors Co., 200 Bloomfield Avenue, Bloomfield, N. J.



Integral HP Motor for Direct Current

STAR MOTORS

POWER PACKAGED AS YOU NEED IT

roasting manganese ore with potash in a rotating kiln at 450 deg. C. with excess air. This was electrolysed in 12,000 amp. cells at 2.8 v. per cell with a current efficiency of 65 percent. The anodes were nickel-plated steel and the cathodes steel.

Sodium was produced by the electrolysis of fused NaCl in the usual way until plants were closed by bombing; thereafter the obsolete Castner process using fused caustic soda was put back into operation.

Some hydrogen was made by the electrolysis of water to augment other supplies. The cells used KOH as electrolyte and operated at 12,000 amp. and 2.2-2.5 v. 5—6 kwh. were required per cubic meter of hydrogen.

Fluorine was produced by electrolysis in a cell made of metallic magnesium with carbon anodes and nickel cathodes. The electrolyte, which was KF x (HF), was kept at 100 deg. C. and heat was not dissipated since liquid HF was fed into the cell and broken down into H_2 and F_2. The gases from the cell were passed through a coil immersed in dry ice (-80 deg. C.) to remove HF.

7. ROCKET PROPULSION CHEMICALS

A considerable number of chemical systems were studied for use in the propulsion of rockets. Selection of the chemicals was made very largely on the ground of availability rather than desirability. Each system had two main constituents, an oxidizing agent and a fuel. The constituents reacted chemically in a combustion chamber at 30-40 atm. pressure. The products of combustion drove the rocket by passing out through a jet.

The principal oxidizing agents considered were 98-100 percent nitric acid which was found to be too corrosive, 98-100 percent nitric acid with 5-10 strong sulphuric acid added, liquid oxygen which was difficult to handle, 80-85 percent hydrogen peroxide with or without sodium or calcium permanganate, and ammonium nitrate.

The principal fuels considered were methanol, ethanol, hydrazine hydrate, hydrazine plus methanol, 57 percent in xylidine plus 47 percent triethylamine, 8-hydroxyquinoline, furfuryl alcohol, vinyl ethyl ether, gasoline, diesel oil, Optol (a hydrogenated lignite tar fraction) and Ergal (a mixture of Optol, tetrahydrofuran, furfuryl alcohol and aniline).

A few monofuel systems were also studied. These included 65-85 percent methyl nitrate in methanol, ammonium nitrate plus ammonia, ammonia and nitrous oxide, and tetranitromethane plus a solution of 8-hydroxy-quinoline in 80-85 percent hydrogen peroxide. None of these was ever developed to the point of large scale application, some being too dangerous and some unavailable under war conditions. The first mixture above was considered the most promising.

Most of the rockets actually used were propelled either by a combination of liquid oxygen and methanol or ethanol, or by mixed acid (5-10 percent H_2SO_4 plus 95-90 percent HNO_3) with an oxidizable substance. In the case of the V-2 rocket, the starting cycle was in three steps. First, permanganate reacted with hydrogen per-

(Above) Knight-Ware traps for wet chlorine gas lines.

(Right) A combination trap and tower base of Knight-Ware used for handling nitric acid fumes.

Traps for Acids that Bite!

THE above traps are further examples of Knight-Ware acid-proof pipe being effectively used where resistance to acids, alkalies, gases and fumes is vital. They are resistant to all acids except hydrofluoric and are extensively used in carrying processing acids and waste liquids containing corrosive elements.

Other Knight-Ware chemical equipment such as jars, filters, tanks, towers, etc., have been designed by Knight engineers to meet specifications and needs of individual customers. Most of them are made in one jointless piece. Each piece is corrosion-proof throughout the entire body. If you have a problem involving the handling of corrosive materials, Knight engineers will help you find the solution.

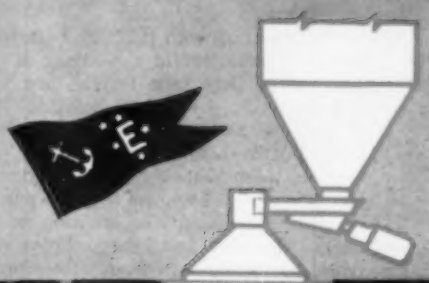
MAURICE A. KNIGHT
109 Kelly Ave., Akron 9, Ohio

KNIGHT-WARE
CHEMICAL EQUIPMENT

Eliminate Guesswork!

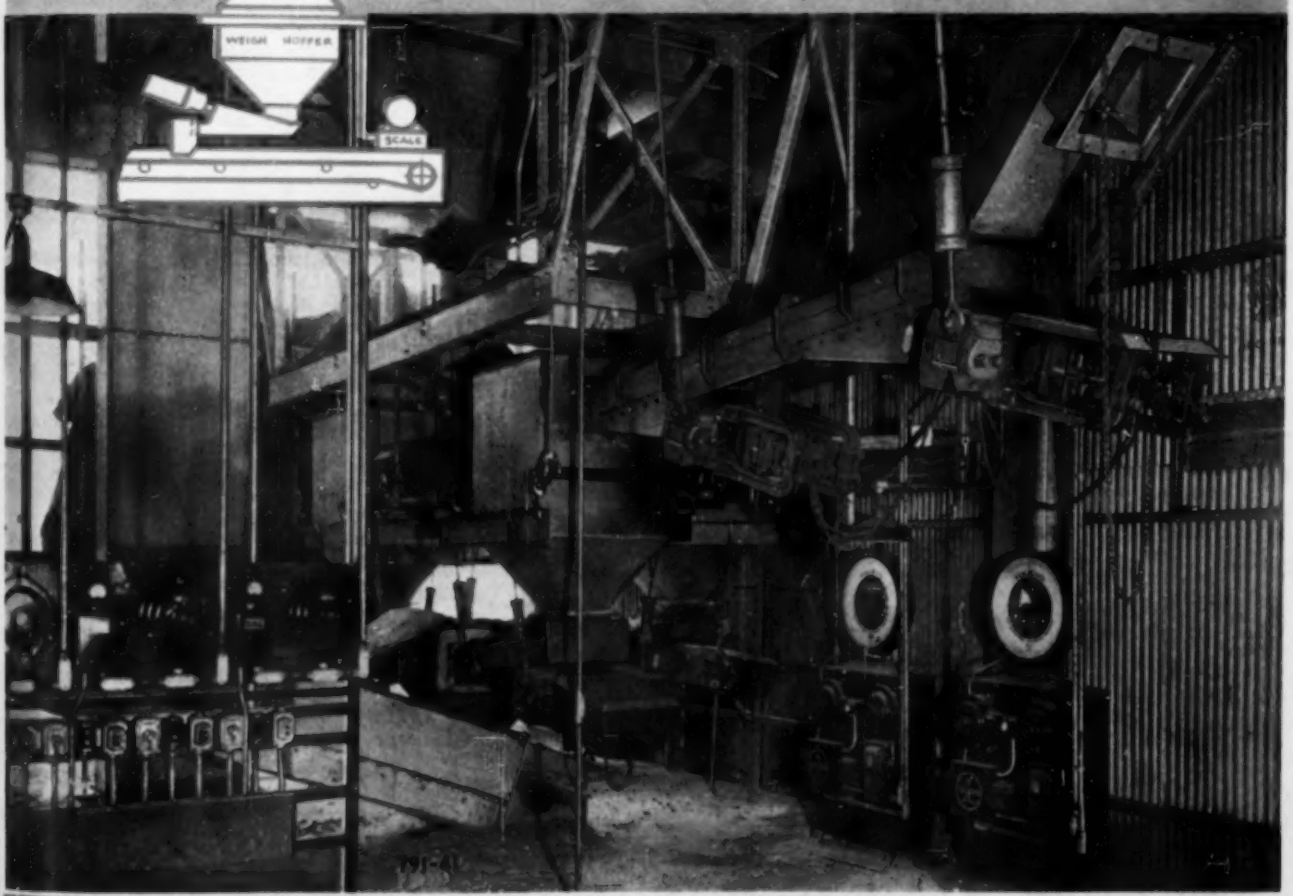
WITH JEFFREY-TRAYLOR

ACCURATE BATCHING



Weighing and proportioning various materials is a simple matter with Jeffrey-Traylor Electric Vibrating Feeders. (Patented)

In the plant shown, three materials are accurately weighed, batched and then discharged from weigh hoppers at a controlled rate to an apron conveyor.



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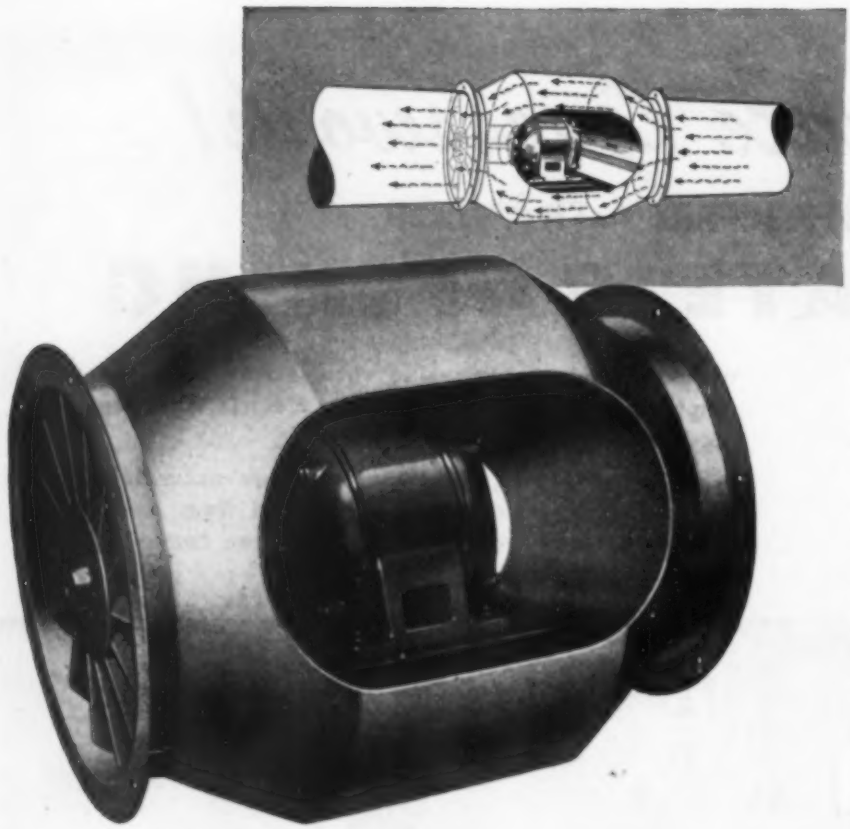

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solved with

DeBOTHEZAT BIFURCATORS

This "Axial Flow" pressure fan unit conveys dusty, dirty, bacteria-laden air, and hazardous gases from the working spaces—solving many problems of employees' health protection.

Installation Is Easy

Installation of the Bifurcator is simple. It is readily installed in the present duct, just like a section of duct work. Operates equally well in any position — vertical through horizontal. No elbow bends or supporting platforms are needed.

How a Bifurcator Ventilator Operates

This different type of ventilating unit is sensibly designed and soundly engineered. The motor is readily accessible and is isolated from the fumes. *Air stream* is *by-passed* AROUND motor chamber *through twin passages,* which converge into the duct at both ends of the Bifurcator. The fan's non-overloading characteristic protects against costly motor failure. Available in a wide range of sizes and air capacities. Write for descriptive literature and prices.

DeBothezat Bifurcators

DeBOTHEZAT FAN DIVISION OF AMERICAN MACHINE AND METALS, INC.
EAST MOLINE, ILLINOIS

oxide, giving superheated steam which drove a turbine connected to the pumps. The pumps delivered hydrogen peroxide and hydrazine hydrate in methanol solution to the combustion chamber, where an instantaneous, strongly exothermic reaction occurred. When the reaction chamber became hot enough, the permanganate and peroxide shut off automatically and the rocket drive was taken over by the liquid oxygen-alcoholic combination. This system was also used, in principle, in experimental torpedoes and was engine tested for the trackless propulsion of submarines at high speed under water.

In connection with the rocket program, the most important of the chemicals produced on a large scale for the first time was concentrated hydrogen peroxide. The usual 30-35 percent commercial solutions made by the potassium persulphate, ammonium persulphate and persulphuric acid processes were brought up to 82-85 percent strength by vacuum concentration in two stages. In the first, the solution was vaporized continuously from a retort maintained at 73 percent concentration and the vapors, after passing through a separator, were fractionally condensed in a scrubbing tower as a 65 percent product. This 65 percent product was then fed into a second retort which was maintained at 80-85 percent. The vapors were again fractionally condensed and the condensate returned to the retort, from which the finished product overflowed. If especially pure solution was required, the product was drawn off the bottom of the scrubber. Acidity was adjusted with phosphoric acid. The product was of very high purity and stability. One plant had a capacity of 500 metric tons per month; a second plant had a capacity of 1,200 tons per month; and a third plant was under construction with a projected capacity of 2,100 tons.

Two non-electrolytic processes were being investigated because of the shortage of platinum and stainless steel. One was based on the passage of H_2 plus O_2 through a silent electrical discharge. The other was based on the reduction with hydrogen of 2-ethyl anthraquinone to 2-ethyl hydroanthraquinone, followed by oxidation to 2-ethyl anthraquinone and H_2O_2. Pilot plants had been operated on both processes and a large plant for the 2-ethyl anthraquinone process was under construction in spite of explosion hazards encountered in the pilot plant.

8. OXIDATION PRODUCTS

Having produced mixtures of numerous hydrocarbons by the reduction (or hydrogenation) of coal in order to manufacture petroleum products, it was a logical step to consider the oxidation of these hydrocarbons to much needed oxygenated products. There is nothing essentially new in these ideas, but the urgency of war demands did much to stimulate work in this field. Production of fatty acids alone has been estimated at about 100,000 tons per year.

The procedure involved taking the mixed hydrocarbons and oxidizing by blowing with air according to standard methods. The resulting mixed fatty acids were then separated by careful fractionation.

The acids of C_1 to C_6 were extracted

VISUAL PYROMETER

ELECTRICAL PYROMETER

PYROMETRIC CONES AND DISCS

Why you can be sure of higher CORROSION-RESISTANCE, positive NON-ABSORPTION *with* LAPP CHEMICAL PORCELAIN

3 **THOROUGHLY VITRIFIED BODY PRODUCED IN THE LAPP CONTINUOUS KILN**

• You can fully capitalize on the many trouble-saving and money-saving advantages of ceramics *only* by getting the *most* out of ceramic ware. LAPP Chemical Porcelain is different because it offers you all the "natural" advantages of ceramics *developed to their highest degree.* Complete corrosion-resistance to all acids (except HF), positive non-absorption, added mechanical strength and purity are *plus* advantages of LAPP Chemical Porcelain. These are made possible by its *extra* dense, homogenous, *thoroughly* vitrified body. A vitally-important contribution to that body is made by the LAPP Continuous Kiln. In a 380-foot tunnel kiln temperatures exceeding 2250°F are precisely controlled so that the formed clay is slowly brought to the exact molten stage where *complete* vitrification occurs. The clay body is transmuted by fusion into *solid* Porcelain, chemically inert and well beyond the degree of vitrification found in ordinary ceramics or vitreous china.

If you've had trouble with ceramics on a problem that ceramics should solve—it will pay you to experience the difference in LAPP Chemical Porcelain. *LAPP Insulator Co., Inc., Chemical Porcelain Division, LeRoy, N. Y.*

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Chemical Porcelain

VALVES • PIPE AND FITTINGS • RASCHIG RINGS • TOWERS • KETTLES • FILTERS • SPECIAL SHAPES

Typical one-bath process. Poor color and density. Insufficient protection and sharp edges on grain structure.

Two baths produce dense color, superior rust protection, equalized grain structure, reduced friction of moving parts.

Microphotos of identical steel surfaces by an impartial laboratory.

Finish the Job Right with PENTRATE (PHYTANIUM-BLENDED)

The only patented 2-BATH Process

(Patent No. 2,192,280)

Pentrate offers permanent solution stability in a black finish for steel.

This two-bath process has been patented by Heatbath, oldest manufacturer in the United States specializing exclusively in metal-treating baths. Long experience and constant experimentation produced Pentrate for fast action and durable results. It actually penetrates metallic surfaces without dimension change, does not break down with continued use and does not require energizers or periodic complete solution replacement.

For certain alloy steels Pentrate is the *only* process that will guarantee proper and uniform blackening. For all steels, it furnishes a better finish in a shorter time and more easily.

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Springfield 1, Massachusetts

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with water while the higher members up to C_{25} were recovered in narrow boiling fractions consisting of a single product or a mixture of as many as six carboxylic acids.

It is of interest to note some of the uses to which these acids were put under war conditions in Germany:

a. C_1 acid (formic) was used largely for treatment of fodder silos.

b. Acetic and butyric acids for esterification of cellulose.

c. Propionic acid in the form of calcium salt as a bread preservative.

d. C_5-C_9 acids were reduced to alcohols and the latter condensed with phthalic anhydride to give glyptal type resins.

e. C_7-C_9 acids for fire extinguishers of the foamite type.

f. C_9-C_{11} acids for mineral flotation.

g. C_{10}-C_{16} acids were converted to soaps for domestic and industrial purposes without further separation.

h. C_9-C_{10} acids after removal of any dicarboxylic acids were converted to edible fats of good quality.

i. C_{18}-C_{24} acids in the form of salts found uses in lubricating greases, as softening agents for leather, and lubricants for plastic moulding.

j. The pitch residues after ketonization and further hydrogenation gave long-chain hydrocarbons useful as vaseline substitutes.

Any of these fractions by reduction can give higher alcohols and aldehydes useful in further synthesis, thus alcohols of C_7 and C_9 were used for alkylation of benzene to form a gasoline additive.

A paraffin wax manufactured by hydrogenation of carbon monoxide was also used as a material for oxidation under pressure with a cobalt catalyst to give mixed fatty acids for soap manufacture.

9. CHLORINATION PRODUCTS

In the absence of natural gas in Germany, methane was separated from coke-oven gas by liquefaction in Linde equipment. The methane was chlorinated in externally heated towers at 370-390 deg. C. with a five to one ratio of methane to chlorine. Methyl chloride, methylene chloride, chloroform and higher chlorination products were condensed with refrigeration and the products separated by distillation. Carbon tetrachloride was made from CS_2 as usual.

Chlorine products containing two carbon atoms were made from acetylene, tetrachlorethane being the first product. Trichlorethylene was made by cracking HCl from tetrachlorethane. Pentachlorethane was made by the addition of chlorine to the tri-chlor products. Perchlorethylene was made by splitting HCl from penta-, and hexa- was made by the addition of chlorine to per-. Dichlorethylenes were made by the reduction of tetra- with iron. Vinyl chloride was made by the reaction of acetylene with anhydrous HCl.

The development of large scale processes for the manufacture of chlorine derivatives of ethylene by way of acetylene was one of the most outstanding achievements of the German chemical industry.

Editor's Note: **This material on the German chemical industry will be continued in a subsequent issue.**

CORROSION FORUM

EDMOND C. FETTER, Assistant Editor

MODERN MATERIALS • MODERN METALS

NEWS BRIEFS

THE Engineers' Society of Western Pennsylvania will hold its Sixth Annual Water Conference at the Hotel William Penn, Pittsburgh, Pa., on Monday and Tuesday, October 22nd and 23rd. A synopsis of the program is given below. The Society's address is Hotel William Penn, Pittsburgh, and the general chairman of the conference is H. M. Olson.

Speakers and their subjects are as follows:

Monday Morning Session—
"Hot Lime Soda of Spaulding Precipitator Design," S. B. Applebaum.
"Experimental Studies of Boiler Scale at 1,500 psi.," J. A. Holmes.
"How to Evaluate Data," V. V. Kendall.

Monday Afternoon Session—
"Behavior of Highly Concentrated Boiler Water," C. E. Kaufman, V. M. Marcy, W. H. Trautman.
"Cold Water Vacuum Dearation," (results, operating data, and costs) Sheppard T. Powell.

Tuesday Morning Session—
"Treatment and Preparation of Water in Rayon Textile Mills," William Habbert.
"Construction and Maintenance of Water Wells," N. E. Gunderson.

Tuesday Afternoon Session—
"Ionic Exchangers," F. K. Lindsay.
"Electrolytic Water Softening for Industrial Purposes," R. E. Briggs.
"Diatamaceous Earth Filtration," H. E. Hollberg and H. N. Armbrust.

VINYL resins have been used in large quantity during the war to coat shipping containers for calcium hypochlorite and acetylene tetrachloride. The corrosion resistant vinyl finishes have been applied to the exterior and interior of 8-gal. containers and to the inner compartment of 6-gal., two-compartment containers used by the Chemical Warfare Service to ship these chemicals overseas.

AN anticorrosive coating for gasoline drums and tanks is set forth in a recent patent issued to A. Wachter. The coatings consist of glycerine-plasticized mucilaginous materials containing an inhibitor such as sodium nitrite. A typical formulation contains 60 percent dextrin, 30 glycerine, and 10 sodium nitrite. The coating, said to be inexpensive and easily applied, is intended primarily to protect gasoline and similar hydrocarbons from contamination by corrosion products formed when the small amount of water present in almost all gasoline separates out during storage and promotes attack on the container.

COATINGS of synthetic rubber, plastic paint and similar materials are being applied as corrosion preventives to the rudders of Liberty ships by the Columbia Steel Casting Co., Portland, Ore. A rudder treated in this manner was placed on the Francis E. Siltz, which was launched at Houston last February and has since made a voyage to England and return. After another voyage, if the rubber-clad rudder proves the merits of the coating, additional rudders will be protected in the same manner. The unusually severe corrosion of propeller, rudder, and stern plate is laid to the electrolytic action resulting from the dissipation of electrical energy through the stern portions of the vessel while it is in motion.

CORROSION REPORTER

THE engineer in charge of maintenance at a large oil treating plant provides the following information.

SULPHONATED OILS

"Our activity at this plant revolves around the saponifying, sulphating, and compounding of a great variety of oils. The diversity of the oils we process and the variety of products we make from them is really the root of our corrosion problem. Since no one of the products we make could keep our equipment busy all the time, it becomes necessary to use our apparatus on first one kind of oil and then another. This becomes especially serious in the sulphonation of oils because some oils finish on the acid side, while others are slightly alkaline. The equipment, therefore, is exposed alternately to acid and alkaline environment. This condition does not actually obtain in the sulphonating vessel itself, for here a large excess of sulphuric acid is added to the oil to maintain a constant acidity. For these vessels and the cooling coils inside them, we formerly used Tonkin iron and found it to be about six times as long lasting as plain wrought iron. We now use lead-lined vessels and find them to be even better than the Tonkin.

"Another innovation we made some years ago was to install Monel coils; we had a terrible time with them. First the welds corroded and then pitting played hob with the whole coil. However, this probably was not the fault of the metal itself. We took the coils out a year ago and had them heat-treated. They have been reinstalled and have given no trouble for a year; at least we have had no leakage of brine into the vessel. A corrosion expert sent here by the government has recommended that we use Durimet 20 for this equipment.

"Our real trouble starts when we dump the acidified oil into a tank where the excess acid is diluted and neutralized. Depending upon the oil we are working with, the final product may be either slightly basic, neutral, or acid. For the wash tank where this is done we have tried several kinds of metal—Monel, lead, stainless steel—and find that none will stand up throughout the pH range which we encounter with our various products. We get our best service, 1-2 years, by building the tank of good cypress wood. Cooling coils inside the wooden tank are made of Monel or stainless, but they have to be replaced periodically."

ACETIC ACID

"ACETIC ACID'S corrosiveness is extremely sensitive to the presence of air," reports the chief engineer in a medium sized eastern chemical plant. "Consequently all pumps, valves and pipelines must be absolutely air-tight or corrosion can cost a small fortune in lost time and maintenance.

"Glacial acetic acid is handled with 18-8 stainless steel pumps and valves trimmed with 18-8. Pipe lines are either aluminum or rubber-lined steel. Aluminum is used for storage tanks; aluminum, glass or Douglas fir is used for shipping containers.

"Concentrations other than glacial (up to about 80 percent) are pumped and piped in lead, but we hasten to add that we are not a food processor and lead contamination of the acid is not an issue. Lead is corroded by acetic at room temperature, but for our purpose the attack does not exceed reasonable limits nor does it justify the expense of a more resistant material like copper or Cr-Ni stainless steel. We do get into trouble with lead if we allow acid to lie in the lines, in which case the line may become clogged with lead acetate. Concentrations up to 84 percent are stored in bulk in large Douglas fir tanks and shipped in oak barrels; the Douglas fir need not be treated but oak requires a paraffin lining to prevent leakage.

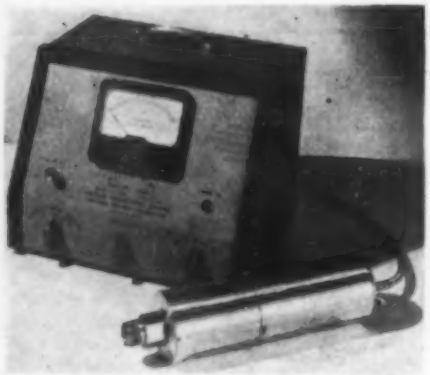
"In distilling an 80 percent solution of acetic acid, a copper vessel, copper steam coil, and copper condenser are used. Corrosion is serious only in the case of the steam coil—and here, only over a two- or three-foot length of tubing at the cold end. However, until corrective measures were taken, corrosion at this point was so severe that the coil had to be replaced every few days. To solve the problem we inserted a few feet of silver pipe at the cold end; silver has excellent resistance to hot acetic acid, liquid or vapor, and by using only a few feet of it at the critical point we obtained at little expense a coil construction that lasts up to two years.

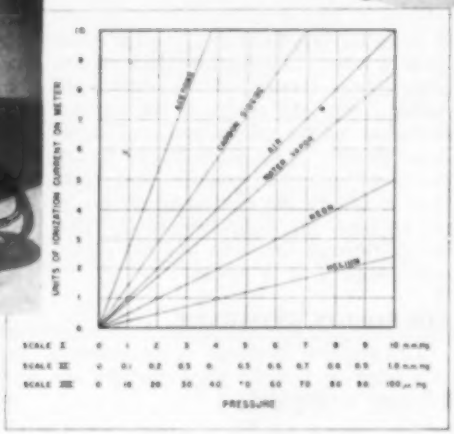
"There is a reasonable explanation for the coil's corroding only at its cold end; it lies in the two facts that (1) the rest of the coil is located at the bottom of the vessel and is covered by a heavy, viscous sludge which protects it, and (2) acetic acid is most corrosive at the point where its vapors are condensing and it is more than likely that there is some acid con-

In Vacuum Gauges . . . its the new

Alphatron

No. 3 in series on new developments in the field of High Vacuum





Alphatron Gauge Type 510
Preliminary Calibration Scale

1 micron to 10 millimeters . A single gauge giving continuous linear indication of pressure in three ranges: 1–100 microns; 1–1000 microns and 1–10 millimeters.

instantaneous response . . The Alphatron utilizes the ionization effect of alpha particles. This new principle enables instantaneous response to pressure change and thus avoids lag in readings.

undamaged by atmospheric pressure . . . . . The flow of alpha particles is produced from a sealed radium source. There is no filament to burn out, and the gauge is unaffected by exposure to atmospheric pressure.

simple calibration for different gases . . . . . The graph above shows that the Alphatron has linear reactions to pressure throughout its entire range. Calibrated for dry air the standard Alphatron may be used directly for other gases by means of calibration factors. Excellent for use with systems containing water vapor and for leak detecting.

specifications . . . . . Control box: size 12⅝" x 9¼" x 9⅜", weight 20 lbs., finish grey and black crackle with red trim; gauge (including first stage amplifier); size, 12" x 3" O. D., weight 5 lbs., finish natural; cables: 10 feet special 10 conductor; power 110 volts, 60 cycle, A. C., 1 ampere; calibration as shipped: dry air; shipping weight; approximately 27 lbs.

Vacuum ENGINEERING DIVISION
NATIONAL RESEARCH CORPORATION
BOSTON 13, MASSACHUSETTS, U.S.A.
High Vacuum for Industry

For full particulars send for bulletin G-3.

densation on the tube wall where the cold end of the coil passes out of the vessel by way of the vapor space."

LITERATURE REVIEW

"Pipe Service Tests on Baltimore Water," Charles F. Bonilla, *Trans.* The Electrochemical Society, preprint 87-20, 1945, pp. 227-243: Reports pitting results from service tests of up to 15-yr. duration on black and galvanized wrought iron and steel pipe carrying cold water, hot water, and returning condensate.

"The Comparative Effect of Carbon and Nitrogen on Intergranular Corrosion of 18-8 Stainless Steel," H. H. Uhlig, *Trans.* The Electrochemical Society, preprint 87-13, 1945, pp. 141-154.

"An Apparatus for Measuring Corrosion," Morris Cohen, *Trans.* The Electrochemical Society, preprint 87-19, 1945, pp. 221-226:—Describes a laboratory apparatus which keeps the test solution moving back and forth across the metal specimen. Presents test results showing good reproductibility.

"Protective Treatments for Magnesium Alloys," J. L. Bleiweiss and A. J. Fusco, *Metals and Alloys*, Feb. 1945, pp. 417-434:—A correlated, 18-page review of the surface treatments developed to protect Mg alloys, with data on methods and materials used in each process. Separate sections on magnesium's resistance to various chemicals, plating Mg, painting Mg, influence of alloy composition on corrosion.

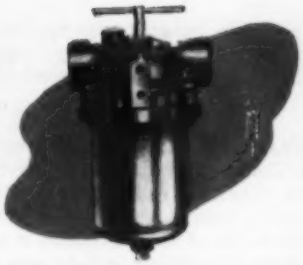
"Stainless Steels," *Machine Design*, Feb. 1945, pp. 175-178:—A collection of engineering data on Types 430 and 430F, particularly the mechanical properties of importance in design and fabrication.

"Correcting Problems Caused by Scale and Corrosion in Compressor Stations," P. V. Sanders, *Petroleum Engineer*, March 1945, p. 208+:—Review and evaluation of methods for controlling scale and corrosion in jacket cooling water systems.

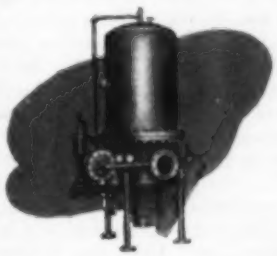
"Tubing and Casing Corrosion Combatted by Treated Water," F. B. Taylor, *Oil and Gas Journal*, March 31, 1945, p. 306:—Describes oil-field method for protecting tubing and casing of water-drive wells by filling the tubing-casing annulus with treated water, thus excluding corrosive formation waters.

"The Welding of Process Piping," Arthur N. Kugler, *Heating and Ventilating*, Feb. 1945, pp. 57-62+; March, pp. 65-68; April, pp. 71-74; May, pp. 89-93:—Discussion of proper welding methods for joining, to themselves or to each other, some of the metals and alloys commonly used in process piping.

"Reclaiming Used Pipe for Oil-Field Operations with Cement Lining," Peter Grandone, Bureau of Mines *Information Circular* 7314, March 1945, 10 pages:—Tells procedure used by mid-continent oil operators during the war to reclaim large quantities of used and badly corroded oil-



AUTO-KLEAN *disc-type*. For all fluids except those containing highly abrasive solids. Viscosities from 30 to 50,000 Saybolt Seconds. Cleaner blades give positive mechanical cleaning of filter element (manually or motor-driven). Handles full flow, yet no larger than usual partial-flow type. Minimum pressure drop. Continuously cleanable. Sizes from 1¼" diam. x ⅞" cartridges to massive motor-driven models. With variety of built-in types.



FLO-KLEAN *wire-wound*. For fluids containing highly abrasive solids such as metal chips, abrasive wheel particles, sand, etc. May be designed to remove particles .0025" or larger. Motor-driven backwash nozzle gives positive hydraulic cleaning of filter element. Low pressure drop — fluid moves in straight line, encountering only momentary restriction. All parts made of metal — constructions to meet varying corrosive and erosive conditions.

AIR-LINE *for compressed air*. Removes solids, entrained moisture and oil from compressed air. It is an edge-type filter of metal disc construction. Brass element has .0015" spacing. No cleaner blades. Removal of trapped dirt, water and oil is accomplished by opening petcock at bottom.

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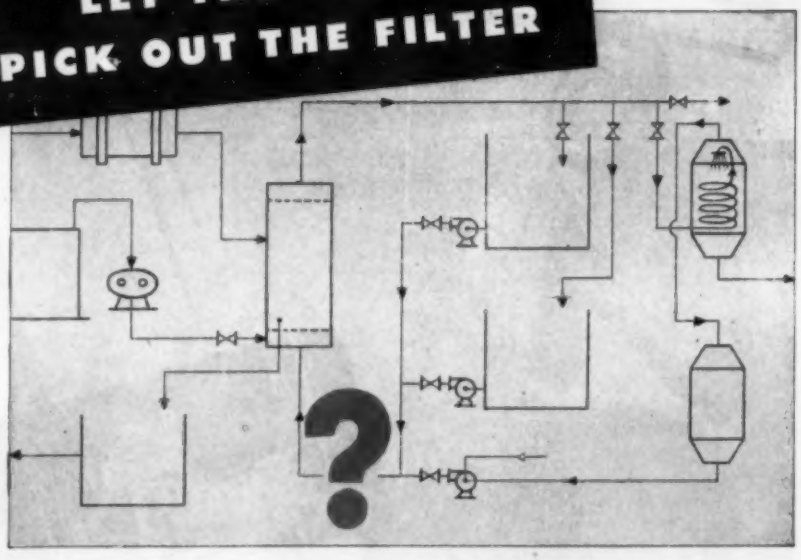

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Then decide how clean the fluid should be — how clean it is to start with, and how clean it should be kept. When these matters have been settled, the choice of a fluid-cleaning method is easy — because, in the Cuno line, you will find the filter that will keep flow on "Go".

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. . . that's a familiar refrain among engineers and production men in every field —diesel, oil, power, machinery, steel and many others. It's not hard to understand why REX-WELD has achieved such high standing with users of flexible metal hose!

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For industrial men know that REX-WELD Flexible Metal Hose provides an added measure of strength and dependability for heavy-duty jobs. That's because it is fabricated from strip metal by a precision autogenous welding process that makes *a weld stronger than the tube.* In addition, C.M.H.'s advanced "50-50" principle of construction produces deep, uniform corrugations with less working of the tube walls. The result—flexible metal hose with greater inherent strength . . . extra flexibility . . . longer service life!

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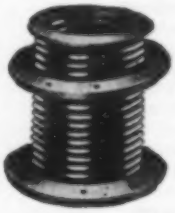

RW-89 Diesel Exhaust Unit.

Small wonder, then, that when the job calls for flexible metal hose—industrial men say, "Let's use REX-WELD!"

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field piping by lining it with cement. Reports that cement-lined "scrap" pipe frequently serves as well as new cement-lined pipe.

"Weather Resistance of Cellulose Ester Plastic Compositions," L. W. A. Meyer and W. M. Gearhart, *Ind. and Eng. Chem., Anal. Ed.*, March 1945, pp. 232-239:—Reports results of an investigation in which a number of cellulose acetate and cellulose acetate butyrate plastics were exposed outdoors in Arizona, Florida, and Tennessee for the purpose of studying the effect of weather on appearance and physical properties.

"Effect of Aeration on Hydrogen-Ion Concentration of Soils in Relation to Identification of Corrosive Soils," Melvin Romanoff, National Bureau of Standards *Journal of Research*, March 1945, pp. 227-241:—Records an investigation which demonstrates the unreliability of pH measurements of soil if samples have been air-dried. Concludes that, for the identification of areas corrosive to iron and steel, pH measurements should be made on soil samples in their natural field condition.

"Clad Steels for Corrosive Service," H. S. Blumberg, *Corrosion and Material Protection*, April 1945, pp. 11-16:—Generalized commentary covering mechanical properties of various backing and facing metals, methods for producing and methods for fabricating clad steel, economic considerations in the use of clad steel.

"Planning and Interpreting Corrosion Tests," F. L. LaQue and B. B. Knapp, *Corrosion and Material Protection*, April 1945, pp. 17-23:—Points out many of the opportunities for error in corrosion testing. Many factors that can greatly affect corrosion rates are sometimes overlooked by investigators with the embarrassing result that test results are not borne out in service. Some of the pitfalls listed are, for example: improper ratio between area of metal and volume of test solution, neglect of waterline and intermittent immersion effects, improper ratio between areas of anode and cathode in galvanic studies.

"Cable Trouble Caused by Spilled Chemicals," N. W. Thurston, *Electrical World*, April 28, 1945, pp. 80-81:—Describes method used to locate point on underground power cable where a failure had occurred due to corrosion by chemicals spilled on the ground. Since "spilled chemicals" are not uncommon, any chemical plant might someday find the technique useful.

"Corrosion Resistant Anti-Friction Bearings," H. Habart, *Iron Age*, April 19, 1945, p. 70:—Appraisal of Monel, stainless steel, and beryllium copper for use in anti-friction bearings.

"Welding Corrosion Resistant Alloys to Protect Process Equipment and Techniques of Lining Pressure Vessels," J. A. Gallaher, *Petroleum Refiner*, April 1945, pp. 106-113:—Comprehensive discussion of the techniques that have been used in welding the Hastelloy alloys.

FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

CONTRACTING EXPERIENCE, in which all of the expenditures for labor and materials come out of the private treasury, develops the habit of thrift and vigilance. When a contractor makes a mistake, he pays the price. We submitted a tender for a power house for a naval coaling station at California City. This building was to be erected just back of the sea wall and barely cleared the toe of a rock cliff that rose out of the water like the New Jersey Palisades. Our figure was low, but the government returned all of the bids. The next year, the plans were sent out again. Our estimator compared the figures of the year before and found everything in agreement as to the building, but he did not check the excavation or notice that the building had been moved into the hill. In fact, he did not discover this until we started the job, and then we contributed the cost of blasting a block of rock almost equal to the volume of the building.

SOME ATTRACTIVE JOBS were brought to San Francisco in 1915 by the Panama Pacific Exposition. When the striving had to some extent mollified and the bidders were increasing the "age of the stenographer," which was added for good measurement at the end of the cost estimate, we also joined in the competition.

We obtained several of the smaller buildings and some acreage of exhibits. We had an acre of installations for the U. S. Steel Corp., and just as delivery had been made of a carload of nails with the trade name of arch competitor C.F.&I. prominently displayed on the heads of the kegs, President Farrell arrived with a party of U. S. Steel officials. He pointed out to the local manager the desirability of giving his contractor some instruction in reciprocal trade practices.

THE DEPT. OF THE INTERIOR had made an appropriation for a mining exhibit under the Mining Building. This building was supported on pile stilts on tide lands which had been filled by hydraulic dredging. The Government's plan was to level the mud in the cellar and build a waterproof floor and retaining wall to provide a dry cellar covering an acre in area. The floor level was two feet below mean tide. The specifications anticipated a heavy seepage of water during periods of high tide, and accordingly, the bids for concrete work came to about $30,000 which exceeded the appropriation for that portion of the work.

With the Government's approval, we revised the specifications and did the job for $6,000. We found that the clay fill that had been pumped in possessed imperviousness to a considerable degree. It was more economical to let the water come in and then pump it out than to build a concrete slab heavy enough to make a dry floor. A drain ditch was therefore dug around the perimeter, and the entire area serviced with a network of drain tile heading up in a central sump where an exhibitor's automatic mine pump was installed. The entire area was paved with a 3-in. concrete slab of concrete finished with a broom. Incidentally, the water oozing out here and there and flowing in gutters to the sump imparted to the mine a realistic look. The total cost was a few hundred dollars for the tile and 8 c. per sq. ft. for the paving.

After this, there followed a profitable job of installing make-believe mines and tunnels and a variety of mining machinery exhibits. For leveling the mud in the cellar, it was expedient to employ a pair of mules. As the building was closed around the walls, the only means of access to the new mine was by way of a trap door in the floor. The mules were therefore delivered by the aid of chain hoists. They exhibited a certain cantankerousness that would have made exciting recording if amateur movie cameras had been available. After a few days the mules learned to enjoy the experience.

AN AUCTIONEER traveled from building to building at the conclusion of the exposition and auctioned off each structure in turn to the highest bidder under the stipulation that the bidder remove the building and level the site. Phil trundled along with the crowd. At the front steps of the New York City Building, which had been built at a cost of $250,000, he joined the sport and the entire building was knocked down to us for $250. Some timbers were salvaged that were useful for current jobs. When we had given effect to the value of these and counted the cost, the returns were just about what a good bonfire would have brought if a rabble of football celebrants had beaten our wreckers to the job.

McCLINTIC-MARSHALL (Bethlehem Steel) were furnishing prison cells for Alcatraz. This federal prison was then called "disciplinary barracks" and was used only for temporary detention of service men whose exuberance occasionally exceeded established limits. McClintic's contract included supervision of the prison labor in the erection of the cells. During a spell of indisposition of Engineer Kyle, we substituted as supervisor. Progress dragged because of the smallness of the crew of prisoners, and we complained to Colonel Turner that this was unreasonably extending our tour of duty. He made immediate correction by calling the Presidio and instructing the sergeant of the guard to crack down on his interpretation of the rules. In a few days the crew was doubled.

A "SWELL" RIVER was the Salinas in California. It provided many a lucrative job along with some comedies and tragedies. It starts in the wooded hills east of the coast range and serves as an interceptor for the drainage from the Sierras.

In the winter, it becomes a torrent while in the summer it hides under a streak of sand. Sometimes a cloudburst cleared out the bed from source to mouth. For a few months the river became a barrier. Then as the water receded, the roadmaster spread some crushed stone on the sand, and made a ford that was passable provided the magneto was high enough above the running board. Otherwise a farmer was conveniently at hand with a team of horses and an itching palm. His job possessed a nepotic quality, being an appointive perquisite of the district supervisor—a "plum," in the vernacular. Its season of lucrativeness was extended as the water lowered by allowing the ruts to depress the roadway.

ENGINEER PARSONS of San Luis Obispo County designed a substantial structure for the Paso Robles crossing and stretched the program for the rest over a four-year period to synchronize with the activities of the tax collector.

A great crowd of bidders met at the court house for the public opening of the bids. When our bid was announced, a shrill whistle, after the manner of a releasing air brake, was let out by some wiseheimers and there was a gleeful stage whisper, "Another amateur bridge builder about to go on the rocks." Our winning bid at about $75,000 was $10,000 below the nearest competitor's. The job included three 170-ft. pin-connected spans with foundation piers sunk through the water-laden quicksand below the usual scouring limit of the floods and there resting on piles.

By act of God, Inspector Charlie Cliff, brother of the district supervisor, was a farmer. He had some squeamishness about even number of spans. It wasn't lucky. A bridge should be divided into three or five trusses. By avocation, Charlie was a bachelor. He lived in a tent under an oak at the bridge site and arose with the whistle of the four o'clock Southern Pacific train from San Francisco. On our occasional arrival on this train, he insisted on our sharing pot luck with him.

When Brother Phil had laid out the center line of the bridge and established the elevations, Charlie purchased a carpenter's level and a package of tacks at the "five and dime." He drove a tack into the

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Weston *All Metal* **THERMOMETERS**

top of the level at each end to delineate the line of sight, mounted the level on an improvised Jacob staff, and with this device he "found" that Phil's elevation on the far side of the river, obtained by the use of a precision instrument costing $300, was three feet low! Phil thanked him, reimbursed him for his 25-cent expenditure, but used his own levels.

Phil got underway with the reinforced concrete caissons and they were sinking gracefully as excavation proceeded until suddenly the sand boiled up on the inside and threw the big box out of plumb. Fortunately, Phil had some piles driven by that time, and with the aid of these and a load of straw to retard the flow of sand, he controlled the sinking till gravel bed was reached.

After the caissons were brought to an even keel and filled with concrete, Phil pushed the job to completion and wound up with a profit. Parsons was mystified when he occasionally observed a departure from his specifications, and the substitution of materials of higher quality and price, but the fact was that these items had been included in the estimate where we thought that the job deserved it.

PILE DRIVING, in our San Francisco operations, had been sublet to a well-known waterfront outfit. The Paso Robles bridge, 250 miles south, was estimated in our own office and accordingly it was ethically permissible for us to seek quotations from the field.

It was generally believed that there was an understanding among the pile drivers of the time under which they would swap courtesy bids. The "competitive" figures that we received tended to corroborate the suspicion. Under this proposition, the contractor who was earmarked for a certain job would be the only one to prepare an estimate. He would tell each bidder how much to bid, and he himself would add a modicum to his price to reimburse each of the "contenders." We could not use the quotation. Some weeks later the low bidder called up to ask when we wanted him to start. The answer was that we had built a rig, purchased equipment, hired a crew of local dumb-bells and finished the job, having spent for the entire operation, including the cost of the plant, one-half the amount of his bid!

THE NEXT YEAR the County awarded us a little bridge at Atascadero and a 200-ft. pin-connected span over the Salinas about 18 miles inside the wilderness east of Santa Margarita. The farmer inspector explained that he held the job by the favor of the supervisor of the district. He admitted that he liked the daily pay, but lacked the qualifications. However, he desired to cooperate to the end that the job would be a credit to everybody!

One day, while plowing uphill through the dust on a single-lane road towards the bridge site, the chronicler met a farmer head-on carting some red-leaded eye-bars. Eye-bars are not articles of ordinary commerce. Inquiry led to the information that the inspector and the foreman at the bridge had instructed him to deliver the bars to the village horse-shoer to have them cut off and rewelded as they were

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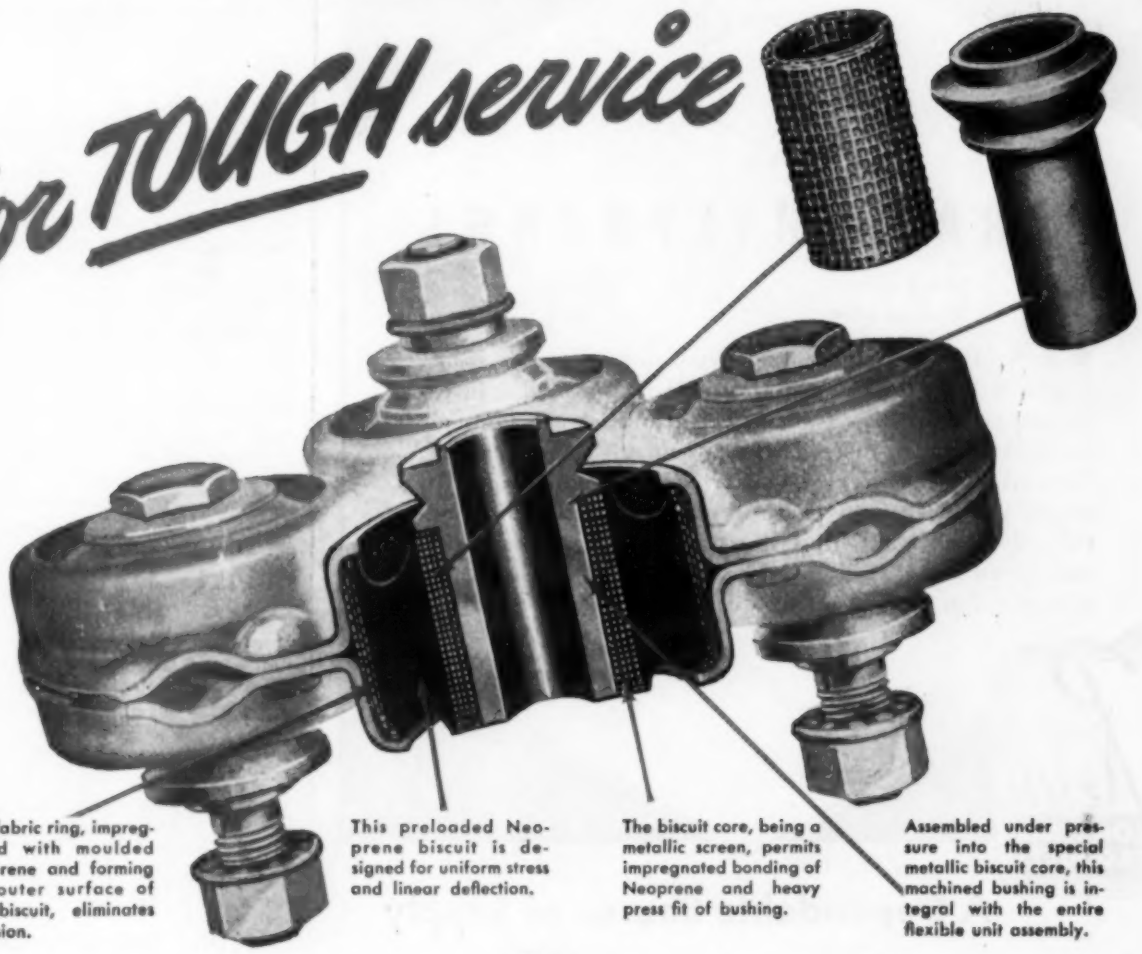
for TOUGH service



This fabric ring, impregnated with moulded Neoprene and forming the outer surface of the biscuit, eliminates abrasion.

This preloaded Neoprene biscuit is designed for uniform stress and linear deflection.

The biscuit core, being a metallic screen, permits impregnated bonding of Neoprene and heavy press fit of bushing.

Assembled under pressure into the special metallic biscuit core, this machined bushing is integral with the entire flexible unit assembly.

Oval Flange type supplied in eleven sizes from 8-foot pounds to 725-foot pounds of torque.

Morflex Couplings withstand severe punishment under the most adverse conditions. Utilizing exclusively Morse-designed rubber biscuits preloaded in assembly, they require no lubrication and are sealed against dirt, dust, and weather. Positive direct drive with no power loss, Morflex Couplings with their inherent flexibility reduce bearing wear, permit slight angular misalignment, ease thrust and torsional loads, and absorb shocks, uneven impulses and vibration. They are constructed to eliminate all action between metal-to-metal surfaces; are therefore trouble-free and long-lived. In short, they are engineered for tough, dependable service. Call the Morse engineer or write Morflex Dept. Detroit for information on your specific applications.

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MORSE Roller and Silent CHAINS

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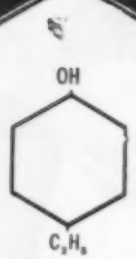

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1½-in. too short! These eye-bars were forged by the American Bridge Co. under whose system of inspection there can be no error. The farmer was therefore ordered to return his load to the job.

The bridge was completely erected except the eye-bars at one end-panel. Rechecking disclosed that the falsework had settled. In an hour's time the low points were jacked up and the bars slid easily into place. If they had been cut off, the job would have been delayed three months, as the method of making safe welds in such an important member had not yet been developed. Within three months, the flood would have washed the falsework and the bridge into the river.

BY NIGHT the chronicler headed back towards Paso Robles where a comfortable guest house was available. The darkness of the night gave the crooked road and the thick forest a spooky look. As the car was getting a good start down a ravine so as to make the following hill in high (a favorite sport in 1915), a bulls-eye lantern swung across the road. The first impulse was to accelerate past the light but a sharp "halt" and a glistening gun barrel counseled compliance.

The hold-up man, amid profuse profanity got in the back of the car, brandished his gun, and ordered procedure directly into Paso Robles. It was mystifying that he did not shun the bright lights. However, after turning several corners, a saloon was reached and by orders of the hold-up man, we entered the rear door. Within, he announced, "Here he is!" The sheriff, headquartering there, greeted "Hello, Dan!" After explanations, the green deputy sheriff admitted that he had the wrong man!

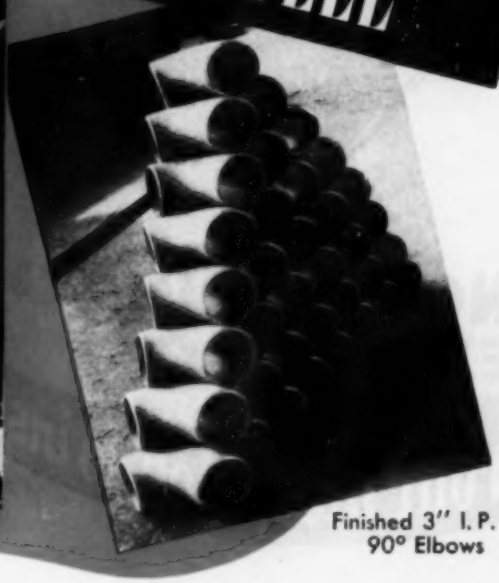
GETTING THE CONTRACTS from San Louis County grew to be a habit. The next year we were awarded a bridge 4½ miles east of Paso Robles and one at Chandon, 15 miles beyond. These being located in Supervisor Cliff's territory, the inspector's plums were assigned respectively to brothers Charlie and Norman. The foundations were pushed through with dispatch, but the steel was delayed by World War I priorities. It became evident that an extension of the contract period would have to be requested at the next meeting of the Board. It was rumored that Supervisor Cliff would be agreeable but "of course" the contractor would be expected to reimburse the County for the wages of the inspectors.

To counteract this, we also launched a whisper that the contractor would, of course, cheerfully pay the inspector's wages for the time actually spent on the job. Our watchman's log had shown that these two brethren had made only one short inspection trip per week to the bridge sites while the rest of the time was spent attending to the crops. This was indeed the proper thing to do, since there was no work in progress on the bridges anyway. At the next meeting, Supervisor Cliff moved that "the boys" be given an extension of six months without penalty.

The delay in the steel brought the erection of the Chandon trusses into the hazardous season. Cloudbursts came with-

PRECISION WELDING FITTINGS OF STAINLESS STEEL

Facing and Beveling—NOTE Special Clamping Fixture



Finished 3" I. P. S. 90° Elbows

THE manufacture of Stainless Steel Welding Fittings and Tubing to exact dimensions and uniform standards required us to design and develop much specialized equipment. Photograph above shows special clamping fixture used to assure precision facing and beveling of 90° Elbows. It is indicative of the care that is exercised in the manufacture of all of our Stainless Steel products, whether it involves a single fitting or large, intricate assemblies.

Welding Fittings include 45° and 90° Elbows, 180° Return Bends, Reducers, Tees, Caps, and Lap-joint Nipples.

I.P.S. sizes range from ½" to 10"; tube sizes from 1" to 24". Available in Stainless Types Nos. 304, 316, 321, 347; also furnished in other analyses.

Fittings are annealed, blasted, and passivated for best corrosion resistance. The ends are accurately machine cut and beveled to 37½° with approximately 1/16" straight face. The radius of each Elbow is 1½ times the nominal pipe diameter.

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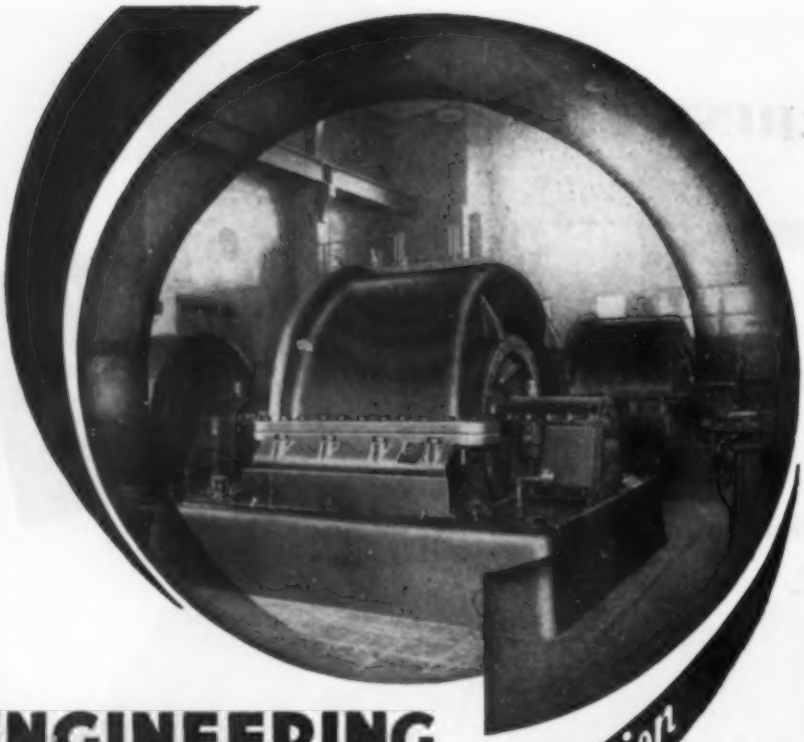

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APPEARANCE *may not tell the whole story*

A watch with 7-jewel works in a cheaply-plated case may look, when new, just as good as a 21-jewel works in a solid gold case. The true value shows up in performance—and time is the test.

ROOTS-CONNERSVILLE BLOWER CORP.

One of the Dresser Industries

509 Illinois Avenue, Connersville, Indiana

WRITE FOR BULLETIN 120 - B - 12

Roots CONNERSVILLE SINCE 1854 Centrifugal EXHAUSTERS and BLOWERS

out warning. When the sky turned black one evening, we had completed all of the spans but one, and this one was resting on the falsework complete except as to the last two panels. By the light of lanterns and bonfires, we kept at it till we reached the last bent of falsework which was supported on a higher sand bank and seemed more safe. We got the unfinished end anchored with cables to the concrete abutment when the wind and storm forced cessation of work.

Daylight brought a "rainbow in the morning." All of the falsework had been washed out except the bent under the unfinished end! This one sagged, but the anchors held it long enough to permit installing the steel that transferred the load to the abutment. In the evening, the falsework drifted away with the flood.

THE COUNTY SUPERVISORS had overlooked an obligation to buy $50,000 in War Bonds and the budget was therefore short by this amount, while the new tax levy was several months off. Most of this was due on our contracts. Some little creditors were threatening to sue the Supervisors or their bondsmen, so Chairman Black invited a conference at the next meeting of the Board at San Luis Obispo.

It was always a pleasure to visit the village with its settlement of Swiss farmers. Besides, R. E. Jack, former superintendent of the big Spreckels sugar works, lived there and we were projecting plans for the rehabilitation of the defunct sugar house at Corcoran, California. Furthermore, good old father Sinsheimer lived there, and it was possible to sneak down to Huntington Beach occasionally where Sid Sinsheimer was building the first of the Holly Sugar Corp.'s California factories.

Anyhow, Chairman Black explained that the Board had made an uncomfortable error in arithmetic and that some of the creditors were creating a disturbance. We told him to satisfy the vociferous creditors and delay our bill till the new tax levy came in. We knew, of course, that nothing else was possible and besides the County had one more sizable bridge scheduled for the next year! We took it on from force of habit and set up our construction camp at Miles near the famous Pismo clam farms. The job got started early in the spring, and so there was no competition with the floods. The high water in the fall washed over the deck but the bridge stood as did all the jobs of San Luis Obispo County's Engineer Parsons.

ON THE OTHER HAND, at Nacimiento in Monterey County, there was a particularly treacherous stretch in the Salinas. A friendly competitor from San Jose got this job. He marked time while the good summer weather petered away, having scheduled the completion of the foundations to meet the arrival of the steel. The flood got him just as he was about to deliver the completed bridge to the County. Piers and trusses toppled over into the river. The County Engineers had not designed sufficient stability into the piers. As the wreck had occurred before the acceptance of the work, the County interpreted it as God's punishment of the contractor for his procrastination.

NAMES IN THE NEWS

K. E. Bell

S. D. Kirkpatrick

C. S. Grove, Jr.

Kenneth E. Bell, technical director in charge of research and laboratories, has been elected a vice president of A. C. Lawrence Leather Co., Peabody, Mass. Mr. Bell, who has been with the company for 22 years, was graduated from M.I.T. in 1917 with a degree in chemical engineering. **Robert Sutherland**, who has been with the company for 16 years has been appointed assistant technical director.

Donald B. Keyes, director of OPRD and head of the chemical engineering division of the University of Illinois, has been elected to receive the Honor Scroll awarded annually by the American Institute of Chemists. Presentation will be made in Chicago on October 26.

Frederick L. Hovde, assistant to the president of the University of Rochester, has been named president of Purdue University. A. A. Potter, dean of the school of engineering, will continue as acting president until Dr. Hovde will be able to assume his new duties early in 1946. Dr. Hovde received his degree in chemical engineering from the University of Minnesota in 1929.

Camille Dreyfus has been elected chairman of the Celanese Corp. of America and as such will continue to act as the chief executive officer of the company. **William McC. Cameron** and **J. A. Larkin** have been elected first vice chairman and second vice chairman, respectively, and **Harold Blancke** has been elected president. Other elections which will result in increasing the number of those active in Celanese management include **F. T. Small**, plant manager at Amcelle, Md., **P. D. Cooper**, plant manager at Celco, Va., and **Harry Price**, yarn sales manager, to vice president; **G. H. Richards** to treasurer; **R. O. Gilbert** to secretary.

James Creese, vice president of Stevens Institute of Technology since 1928, has been elected president of Drexel Institute. He assumes his new post October 1.

Sidney D. Kirkpatrick, editor of *Chem. & Met.*, has been announced recipient of the Chemical Industry Medal for 1945. The presentation, made annually by the American Section of the Society of Chemical Industry, will take place in November.

Gaston F. DuBois, vice president and member of the executive committee of Monsanto Chemical Co., has retired.

William A. Bain, Jr., has been appointed head of the engineering department of the Easton Central Research Laboratory of General Aniline & Film Corp.

B. H. Champion has been named assistant superintendent of Hercules Powder Co.'s Synthetics Department plant at Mansfield, Mass.

David M. Houston has been appointed director of the Export Department of Hercules Powder Co. to replace **Theodore M. Switz** who has resigned.

John F. G. Hicks, member of the glass technology staff of Corning Glass Works, has left for Sao Paulo, Brazil, to become a consultant for Corning's affiliate, Cia. Vidraria Santa Marina, for at least a year.

F. T. Beers, manager of the Du Pont, Wash., commercial explosives plant of E. I. du Pont de Nemours & Co., has retired. **R. F. Boltz**, manager of the Alabama Ordnance Works, succeeds Mr. Beers.

Tien-Gi Ling, who received his Ph.D. under Prof. F. H. Rhodes of Cornell and who is now general manager of China Chemical Industries, Ltd., of Chunkking, is a member of the Technical Committee in the United States.

G. Webster Rice has been appointed assistant manager of the Industrial Chemicals Division of McKesson & Robbins with offices in New York. He was formerly with J. T. Baker & Co. in Philadelphia.

C. S. Grove, Jr., formerly with the Du Pont Co., has accepted a position as professor of chemical engineering at the State University of Iowa.

C. E. Deeds has been appointed general superintendent of the Pigment Products Department of Sherwin-Williams Co. with direct supervision of the Chicago White Lead and Coffeyville plants. He will be located at Coffeyville. It has also been announced that **R. A. Thomas**, formerly superintendent of the Coffeyville plant will become technical director there and **George Prewitt** has been named superintendent of the White Lead Plant at Chicago, replacing Mr. Deeds.

Bernard S. Friedman, has been appointed director of research and development for the Reyam Plastic Products Co., Chicago. Dr. Friedman was previously associated with the Universal Oil Products Co. of Riverside, Ill.

L. A. Belding, engineer formerly with General American Transportation Corp. and more recently with Henry J. Kaiser Co., has been named president of Harlan & Hollingsworth Corp. of Wilmington, Del.

Kenneth O. Beatty, Jr., has been appointed the Wolverine Trufin Fellow at the University of Michigan for the year 1945-46. He was formerly professor of chemical engineering at Rhode Island State before coming to Ann Arbor in 1944. The Fellowship was sponsored by the Wolverine Tube Division of the Calumet and Hecla Consolidated Copper Co., Detroit, Mich.

Leo W. Rainard has joined the Institute of Textile Technology, Charlottesville, Va., for work on high polymers.

James V. Winkler, formerly in charge of experimental engineering at the magnesium fabrication laboratory of Dow Chemical Co. in Bay City, Mich., has been added to the Los Angeles staff as

"HERE'S AN EXTINGUISHER THAT'S REALLY PANIC-PROOF!"

Safety engineers don't use extinguishers. Actually, it's *the employees* who are your real fire-fighters.

That's why Randolph "4", lightweight and easy to use, is *ideal* for the amateur. Just ONE HAND snaps this unit from its bracket . . . one trigger-touch sends carbon dioxide gas deep into the blaze —kills the fire in *split-seconds!*

A dry, odorless gas, carbon dioxide cannot damage equipment or conduct electricity. It leaves no stain or mess . . . actually disappears when the fire is out! *Approved by Underwriters' Laboratories.*

Randolph SIMPLIFIES FIRE-FIGHTING

FREE! Send me your new, 16-page booklet "Sharpshooting at Flames." Illustrates how to fight fires and protect property with fast-action carbon dioxide gas.

Name_____

Address_____

RANDOLPH LABORATORIES, INC. 8 EAST KINZIE STREET CHICAGO 11, ILL., U. S. A.

development engineer for magnesium on the West Coast. He will give technical aid to manufacturers who are fabricating and using magnesium.

Allan B. Clow has been appointed to the newly created position of executive vice president and general manager of Gallowhur Chemical Corp., New York. Mr. Clow was formerly assistant to the general manager of Calco Chemical Division of the American Cyanamid Co.

J. Hoy Robertson, formerly associate editor, has succeeded **T. H. Jones** as editor of *The Industrial Chemist and Chemical Manufacturer.*

Edward Van der Pyl has been appointed superintendent of the Norbide Plant by Norton Co., Worcester. He has been with Norton for 30 years and for the last few has been specializing in development work on Norbide and diamond products.

Arthur C. Dreshfield is now technical director of H. P. Smith Paper Co., Chicago. He was formerly director of operations of the Paper Makers Chemical Division of the Hercules Powder Co. at Wilmington, Del.

Harry A. Feldbush, formerly works manager of the Holyoke, Mass., plant of Worthington Pump and Machinery Corp., has been named vice president in charge of engineering for the entire corporation with headquarters at the general offices in Harrison, N. J. **Ralph M. Watson,** formerly chief engineer of the Centrifugal Engineering Division, has been appointed assistant to Mr. Feldbush.

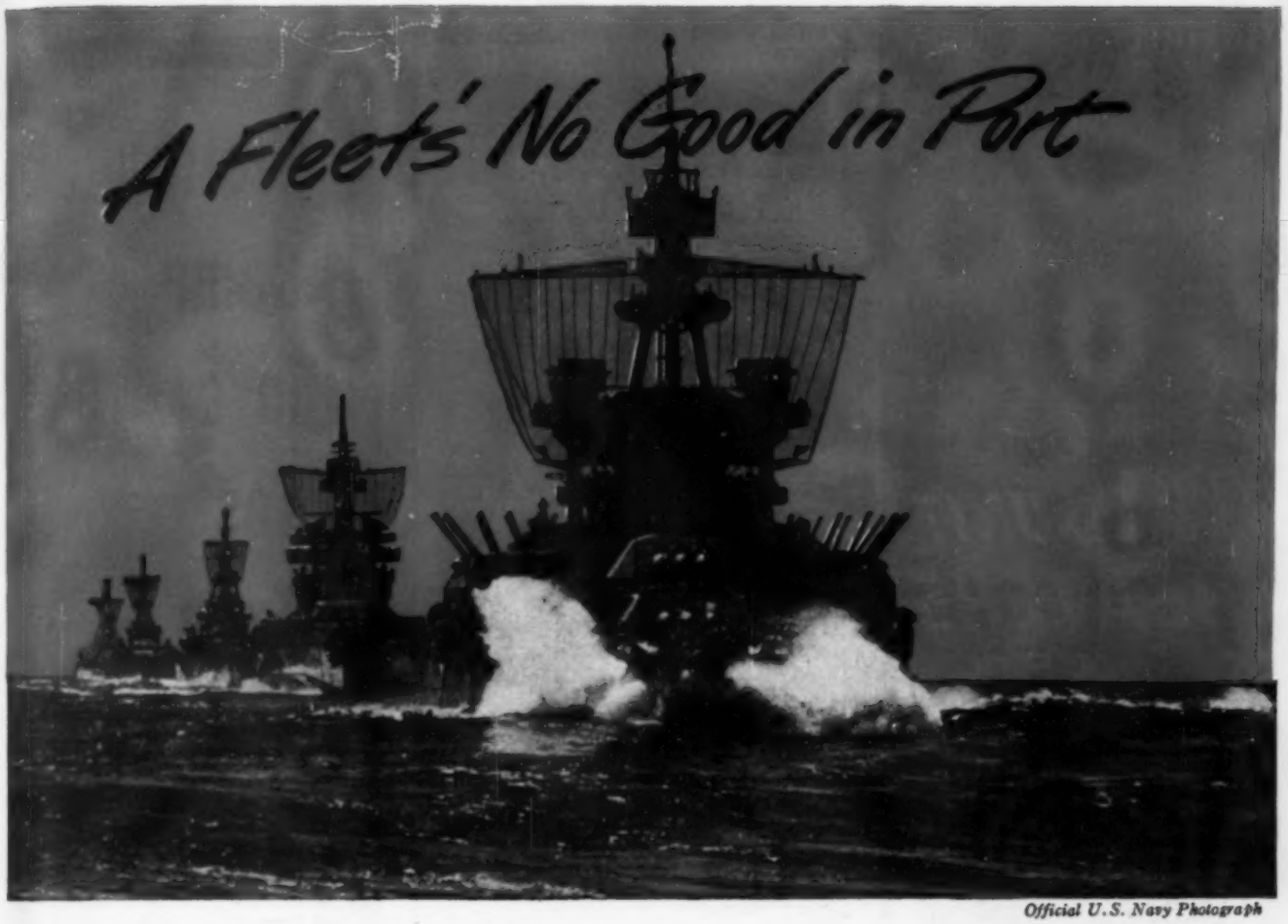
Philip G. Murdoch has been appointed professor of chemical engineering at the A. and M. College of Texas, where he will conduct graduate courses and research. For many years Dr. Murdoch was associated with the Shell Oil Co.

Reynold C. Merrill, formerly with the U. S. Department of Agriculture Regional Laboratory, Albany, Calif., recently joined the research staff of the Philadelphia Quartz Co., Philadelphia, Pa.

C. S. Teitsworth, vice chairman of the manufacturing committee of Socony-Vacuum Oil Co. has been made chairman of that committee to succeed **W. F. Burt** who has been made a vice president and a member of the executive committee.

Maurice C. Taylor, formerly manager of research at the Niagara Falls Laboratories of the Mathieson Alkali Works, has been appointed resident director of research and development. Other research department changes include: **J. Douglas MacMahon,** heretofore assistant manager of the sales department has been named assistant to the technical director; **C. N. Richardson,** superintendent of pilot operations, becomes manager of research engineering.

Earnshaw Cook will resign on January 1 from his position as chief metallurgist of the American Brake Shoe Co. He will be succeeded by **Raymond H. Shaefer,** who



Official U.S. Navy Photograph

Columbia keeps its fleets of Chlorine and Caustic Cars

IN ACTION!

Typical Records . . .

Chlorine Car PPGX 217—
8,742 miles in delivering to eight different industries within 118 days.

Chlorine Car PPGX 223—
8,639 miles in 98 days, also to 8 industries.

Caustic Car GATX 32934—
12,615 miles in 140 days, 14 different industries.

Caustic Car GATX 32941—
10,026 miles, delivering to 18 industries in 140 days.

One of the highly important factors in our Navy's successes has been the maintenance of the various fleets at sea for an extraordinarily high percentage of time. Officers fly back to bases in advance of their fleet's return, for example, to assemble supplies for immediate loading.

Columbia, too, speeds the turnaround of its fleets of special cars. Inspection, reconditioning and loading are handled with all possible dispatch in order to increase the productivity of every car.

Customers and carriers have co-operated in speeding turnarounds and rolling up the miles for a most impressive record for these fleets. This continued teamwork, especially while demands on transportation facilities remain high, will be repaid in the delivery of greater volumes of these essential war supplies.

COLUMBIA CHEMICALS

PITTSBURGH PLATE GLASS COMPANY • COLUMBIA CHEMICAL DIVISION

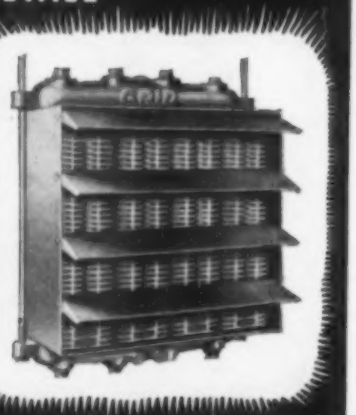
GRANT BUILDING, PITTSBURGH 19, PENNSYLVANIA

Chicago • Boston • St. Louis • Pittsburgh • New York • Cincinnati • Cleveland • Philadelphia • Minneapolis • Charlotte • San Francisco

COLUMBIA ESSENTIAL INDUSTRIAL CHEMICALS

Soda Ash • Caustic Soda • Sodium Bicarbonate • Liquid Chlorine • Silene EF (Hydrated Calcium Silicate) • Calcium Chloride • Soda Briquettes Modified Sodas • Caustic Ash • Phosflake • Calcene T(Precipitated Calcium Carbonate) • Calcium Hypochlorite

INSTALL



GRID UNIT HEATERS

THAT WITHSTAND THE CORROSIVE FUMES OF HCL.....

HERE'S WHY

HIGH TEST CAST IRON HEATING SECTIONS

One piece construction heating sections (patented) of high test cast iron and will withstand steam pressures up to 250 lbs.

No soldered, brazed, welded or expanded connections to become loose or develop leaks.

No electrolysis to cause corrosion, break-downs, leaks or heating failures.

That's why GRID Unit Heaters will withstand the corrosive fumes in chemical plants without maintenance. As one Midwest chemical plant reports, "The materials used in its fabrication are ideal for providing corrosion resistance." After 8 years of continuous operation another chemical plant reports, "We have found cast iron construction stands up very well against the corrosive fumes of HCl, Cl^2, etc. and there has been no maintenance on the units. We certainly recommend GRID for installation where corrosive fumes exist." Is it any wonder that chemical plants are installing GRID Unit Heaters? Complete data and capacity tables upon request.

SEND FOR TODAY

New booklet "Corrosion in Unit Heaters" contains information you should know before you install a unit heater. It is free upon request. Send for it today.

D. J. MURRAY MANUFACTURING CO.
WAUSAU - WISCONSIN

has been assistant chief metallurgist since 1943.

J. Davidson Pratt, previously general manager and secretary of the Association of British Chemical Manufacturers has been appointed director and secretary.

C. H. Greenewalt has been appointed assistant general manager of the Pigments Department of E. I. du Pont de Nemours & Co. For the past six months, Dr. Greenewalt has been an assistant director of the Development Department. Previously he was technical director of the Explosives Department.

Carl E. Cummings has been named to succeed the late **Allan V. Ritchie** as superintendent of Texaco's Beacon Research Laboratory at Beacon, N. Y. Col. Cummings was recently released by the United States Army, which he served as deputy chief petroleum supply officer for the European Theater of Operations.

Nils Anderson, Jr., has been appointed president of the Casein Co. of America. He was formerly chief of the plastics section, Chemicals Bureau, WPB.

H. C. Van Brederode and **J. P. Holmes** have been elected vice presidents of Celanese Co.

Arnold H. Smith has been appointed director of the Foreign Department of Monsanto Chemical Co., to succeed **Herbert M. Hodges** who will retire.

OBITUARIES

Richard N. Mullikin, 57, control manager of the Du Pont Co.'s Organic Chemicals Department, died August 6.

William B. duPont, 31, manager of the Industrial Division of the National Radiator Co., Johnstown, Pa., died in Johnstown August 9.

John B. Berryman, 83, chairman of the board of directors of the Crane Co., died in Chicago August 10.

Richard B. Earle, 69, research expert and a pioneer in the development of synthetic rubber, died August 13.

Philip H. Noyes, 43, an engineer with the Oliver United Filters, Inc., died in Chicago August 18.

John A. Hanley, 54, superintendent of paint manufacturing facilities of the Pittsburgh Plate Glass Co. died August 24.

Erich Loewenstein, 58, biological chemist at Bausch & Lomb Optical Co. died in Rochester August 27.

Robert B. Harper, 63, vice president of the Peoples Gas Light and Coke Co., died in Chicago August 29.

Orlando F. Weber, 66, founder and former president of Allied Chemical & Dye Corp., died in New York September 6.

Victory Came in a Test Tube...

That's more than a figure of speech. The chemical industry made many important contributions to our great military victories in Europe and in the Pacific, but one of the most important was the chemical industry's part in the development of synthetic rubber.

That story has been told to the American public by Bemis Bro. Bag Co. in the advertisement reproduced here which appeared in a recent issue of Time.

In order to make this message available to an even greater audience, Bemis has prepared a poster-size enlargement (17 x 22 inches) in two colors with all advertising deleted. This poster is available to you without charge. Write to Bemis for as many copies as you can use to advantage.

BEMIS BRO. BAG CO.
St. Louis 2, Mo.

★ *Interesting Facts About Another Industry Through Which Bemis Bags Serve Every American Family*

We can't blame Adolph for calling us crazy. It was April 8, 1942... and the headline on Adolph's morning paper read "U. S. SENATE SEES 700,000-TON SYNTHETIC RUBBER PRODUCTION BY '44." You see, even after years of manufacturing, his own synthetic industry had never produced more than 110,000 tons per year... and it had taken years to equip the armies that were rolling through Europe and North Africa. "700,000 tons! Verrückt, those Americans!"

But that was 1942... before Adolph found out about free enterprise... or Yankee ingenuity... or good old-fashioned American teamwork.

Our Senators knew what they were talking about, however, they'd seen the chemical plants springing up all over the country. They knew that the chemical, oil and rubber industries were pulling together... exchanging ideas and formulas.

And they knew what most of us didn't ...that for many years our chemists had been quietly working on synthetic rubber, and the results of these experiments were now being pooled... to bring near-perfect manufacturing efficiency to the new synthetic industry.

Let's see what happened: In 1942, only about 40,000 tons of synthetic rubber went out to fight. But by 1944, streamlined processes and new materials had shaved hours from manufacturing time, and made possible the production of more than 800,000 tons of synthetic rubber—an output that required literally scores of chemicals in unprecedented quantity.

The chemical industry that has helped work this and many other wartime miracles will continue to provide new and even more startling discoveries after peace ...as always, in the interest of greater service to industry and the development of a more comfortable way of life.

☆ ☆ ☆

Special Multiwall paper shipping sacks, many made by Bemis, are the principal containers used by this great new industry for its product.

Bemis makes bags of almost limitless types and sizes for literally hundreds of different uses and new uses are developing daily. Remember, almost everything you eat, use or wear may make at least part of its trip to you in a Bemis Bag.

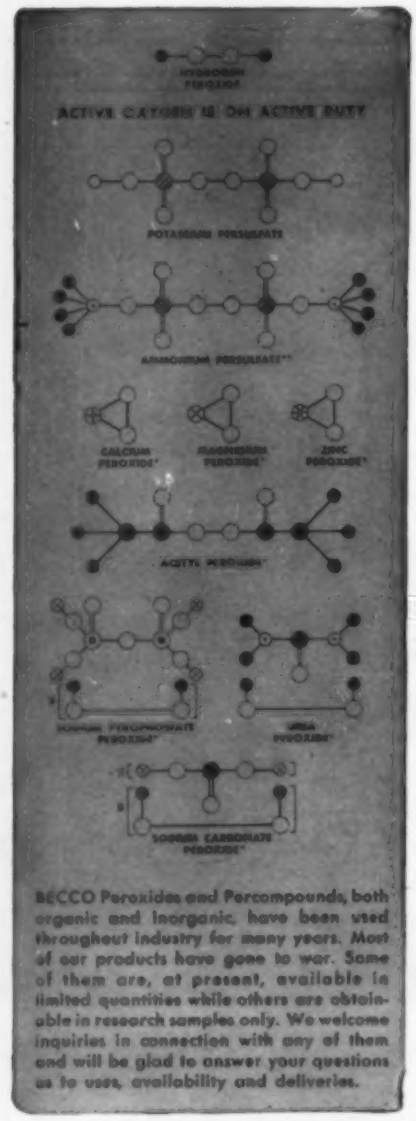
BEMIS BRO. BAG CO.

GENERAL OFFICES: ST. LOUIS

Burlap, Cotton and Paper Bags

24 PLANTS THROUGHOUT THE COUNTRY

EVERY DAY IS BOND-DAY—BUY ANOTHER ONE!



BECCO Peroxides and Percompounds, both organic and inorganic, have been used throughout industry for many years. Most of our products have gone to war. Some of them are, at present, available in limited quantities while others are obtainable in research samples only. We welcome inquiries in connection with any of them and will be glad to answer your questions as to uses, availability and deliveries.

*Available in research quantities only at present.
**Will be available after the war.

BUFFALO
ELECTRO-CHEMICAL
COMPANY, INC.

BECCO SALES CORPORATION
SALES AGENTS BUFFALO 7, N. Y.

INDUSTRIAL NOTES

John I. Thompson & Co., 1317 F St., N. W., Washington, is a newly-formed consulting engineering firm formed by John I. Thompson and associates.

The Vulcanized Rubber Co., New York and Morrisville, Pa., has changed its name to Vulcanized Rubber and Plastics Co. The change was made because the new title is more descriptive of current activities.

The Girdler Corp., Louisville, has appointed Lester N. Harrison southeastern district manager of the Votator division with headquarters in Charlotte, N. C.

The Okonite Co., Passaic, N. J., announces that E. J. Garrigan former vice president and factory sales manager has been appointed vice president in charge of sales and will be responsible for all sales activities of the company. C. E. Brown, Jr., has been moved from Washington to Passaic where he will serve as vice president and general sales manager.

Laclede-Christy Clay Products Co., St. Louis, has named John L. Cummings vice president and director of sales and Julius A. Kayser vice president and general sales manager.

Ampco Metal, Inc., Milwaukee, has made S. C. Lawson assistant general sales manager in charge of field operations. Philip F. Erlandson is eastern zone manager at Newark, N. J.; Wm. J. DeMuth has been transferred from Buffalo to Newark where he becomes district manager; W. T. Peterson has been transferred from Newark to Detroit where he is central zone manager. The Cleveland and Pittsburgh offices have Emil Svoboda as district manager; W. B. McKenzie is the new midwestern zone manager and Jack Bybee is the new district manager at Milwaukee.

Diamond Alkali Co., Pittsburgh, has appointed B. H. Huffman supervisor of Pittsburgh district sales. Associated with him are D. G. Hood and D. W. Powell as sales representatives in Pittsburgh and the tri-state district.

Worthington Pump and Machinery Corp., Harrison, N. J., has promoted Harry A. Feldbush to the position of vice president in charge of engineering for the entire corporation. He had been serving as works manager at Holyoke, Mass.

R-S Products Corp., Philadelphia, has appointed Frank J. Schuman, Plant Engineering & Sales Co., 117 West Ninth St., Los Angeles, as district representative.

Chiksan Co., Brea, Calif., has formed the Chiksan Export Co. to handle export sales. Headquarters will be at Brea with branch

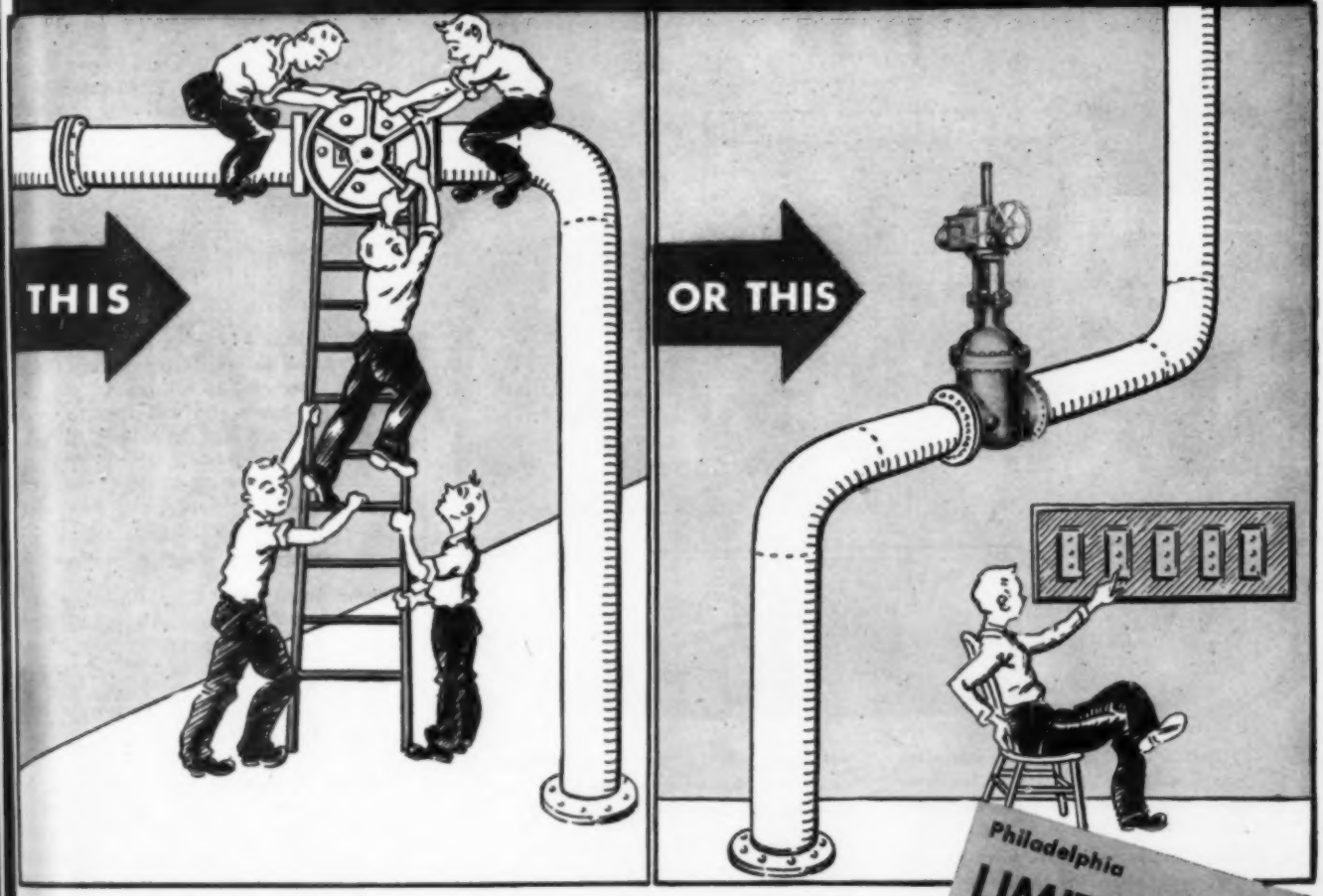
STAINLESS PROCESS VESSELS

LEADER BUILDS
TANKS — KETTLES — FRACTIONATING COLUMNS
HEAT EXCHANGERS and SPECIAL EQUIPMENT
OF
STEEL—STAINLESS STEEL—NICKEL—MONEL
INCONEL — COPPER — EVERDUR — HERCULOY
HASTELLOY — ALUMINUM and CLAD STEELS

LEADER IRON WORKS, INC.
2200 N. JASPER DECATUR, ILLINOIS

WHICH method of valve operation

SAVES TIME
SAVES TROUBLE
PROVIDES GREATER SAFETY



Philadelphia
LIMITORQUE
VALVE CONTROLS

The striking contrast between opening or closing similarly sized valves manually or with LimiTorque Valve Operators is clearly demonstrated in these drawings. LimiTorque Controls enable one man to operate valves up to 96" diameter by merely pushing a button at a centrally located master control panel or a convenient individual push button station. This permits the valve to function at maximum desired speed while eliminating all physical hazards to the workmen.

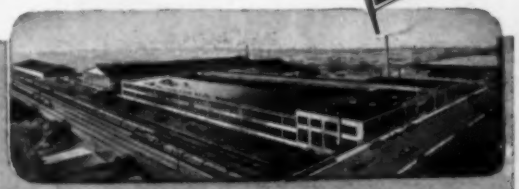
Remote operation of valves from one central point with a full knowledge of their status at all times is entirely practical with LimiTorque. There are several types of LimiTorque Controls applicable for operating all types and sizes of valves and which can be adapted to existing equipment if desired. Floor stand controls can be furnished where it is not practical to fit the controls directly to the valve yokes.

Write us for more details . . . on your business letterhead, please

ARMY E NAVY

Philadelphia GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO



Industrial Gears and Speed Reducers
LimiTorque Valve Controls

AN ORDERLY CONVEYOR-COORDINATED PLANT BESPEAKS AN EFFICIENT PLANT!

PRODUCTION processes coordinated and synchronized with conveyors assure a clean, orderly, efficient plant.

Conveyors break the bottle-necks that cause confusion, congestion, loss of productive man-hours, reduced output. They channel the flow of material and products in process—work flows smoothly without halt or interruption and with the least manual hauling.

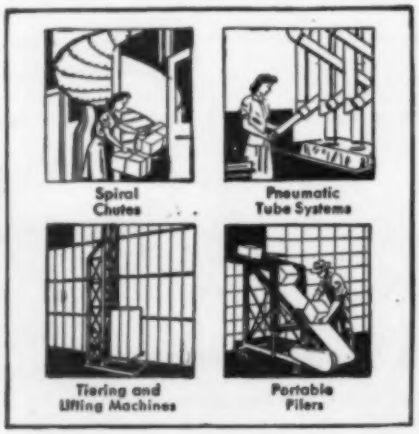
Make the most of your productive time—manpower—space—investigate all the things conveyors can do—the many ways they can earn money for you.

Standard builds roller, belt, chain, slat, push-bar, power and gravity conveyors, spiral chutes, portable pilers, pneumatic tube systems. Standard Conveyor Company is equipped by experience and facilities to make yours a conveyor coordinated plant. Write for valuable reference book "Conveyors by Standard," Catalog No. CM-95

STANDARD CONVEYOR CO.

General Offices: North St. Paul 9, Minn.

Sales and Service in Principal Cities



offices at 50 Church St., New York, under the direction of H. A. Maland, and at Houston, Tex., under the management of G. R. Winder.

Wyandotte Chemicals Corp., Wyandotte, Mich., has placed Edward Heiser in charge of the Cincinnati office of Michigan alkali division. He succeeds G. T. Robinson who has been transferred to Chicago to manage J. B. Ford division sales in the midwestern area.

Moore Products Co., Philadelphia, has opened an office for Michigan, southern Ontario, and northern Ohio in the Penobscot Bldg., Detroit. J. E. Gambrill is in charge of sales and service.

General Ceramics & Steatite Corp., Keasbey, N. J., has appointed Philip H. LePeau as its representative in Louisiana and the eastern part of Texas for the chemical equipment division. He will make his headquarters in the Second National Bank Bldg., Houston, Tex.

Westinghouse Electric Corp., Pittsburgh, has acquired the B. F. Sturtevant Co. of Boston, Mass., which will become a wholly owned subsidiary and will operate as the B. F. Sturtevant Co., a division of Westinghouse. Headquarters of the Westinghouse air conditioning activities will be in Boston but heavy-duty and industrial refrigeration manufacture will continue at Jersey City.

Brown Instrument Co., Philadelphia, a subsidiary of Minneapolis-Honeywell Regulator Co. of Minneapolis, has elected Henry F. Dever president to succeed Charles B. Sweatt. Mr. Dever also will serve as general manager to relieve E. B. Evleth who is in ill health.

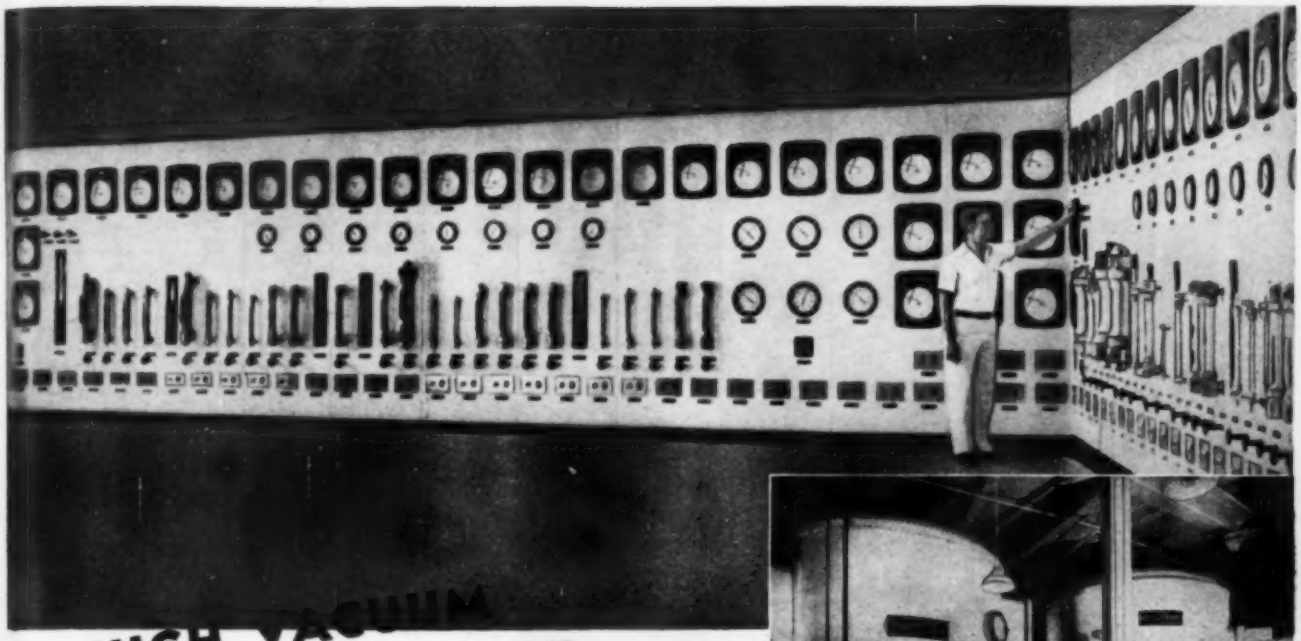
Gotham Instrument Co., New York, has named Robert H. Hix manager of its Chicago branch. Mr. Hix was associated for more than 20 years with the Tagliabue Co. and now will serve as midwestern representative for Gotham.

The Galigher Co., Salt Lake City, Utah, has opened an office for its metallurgical and equipment division at 921 Bergen Ave., Jersey City.

Velsicol Corp., New York, has appointed Wallace F. Helies as assistant sales manager in charge of sales research and marketing. The corporation also has established an office in Detroit under the direction of Gus J. Mayer.

Nordberg Mfg. Co., Milwaukee, has announced that R. R. Shafter who is vice president and general manager of the Nordberg process machinery division will also act as eastern manager of the crusher division. Headquarters for both divisions will remain at 60 E. 42d St., New York. Jack Bond has been transferred from the Washington office to New York where he will cover the eastern territory as sales engineer.

Republic Steel Corp., Cleveland, has elected N. J. Clarke senior vice president

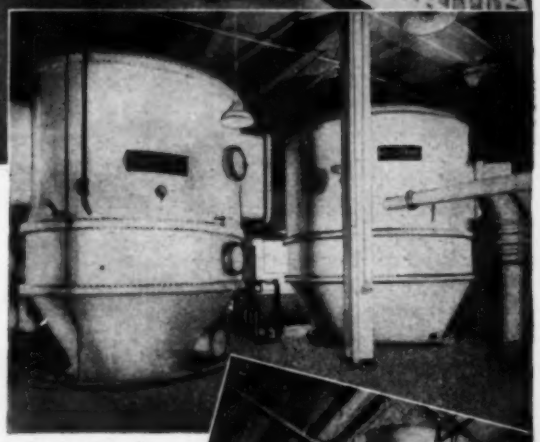


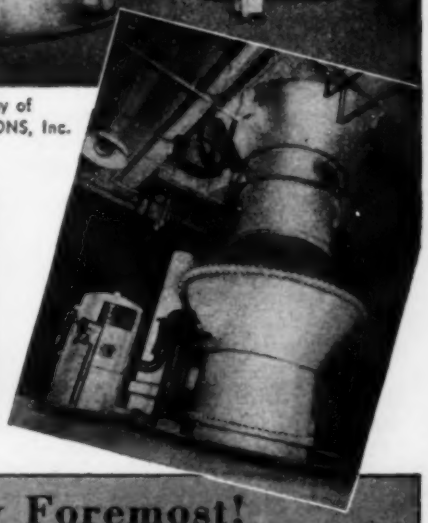
HIGH VACUUM

DISTILLATION UNITS

for the Production of

SUPERLATIVE QUALITY NEUTRAL SPIRITS





Photographs by courtesy of
JOSEPH E. SEAGRAM & SONS, Inc.

Designed and built by

VULCAN

Engineers and Fabricators of

DISTILLATION
EVAPORATION
EXTRACTION

PROCESSES and EQUIPMENT

Quality Foremost!

EIGHT YEARS ago the Vulcan organization designed and built the first high vacuum Continuous Distillation Unit for the production of Neutral Spirits. The product obtained from this first unit was of the highest quality ever commercially produced. These results inspired the Vulcan Research and Development Division to seek still further improvements in high vacuum distillation technique.

The distillation units shown in the above photographs, which are now in operation at the Lawrenceburg distillery of the Joseph E. Seagram and Sons, Inc., represent the culmination of these efforts to produce Neutral Spirits of superlative quality.

Vulcan equipment and processes, including the high vacuum spray-type beer stills in which the fermented mash is distilled at room temperature; and the Vapor Re-use method of distillation which effects substantial savings in steam and water requirements, are important features of these distillation units. The super-fine quality of the alcohol being produced is the most tangible tribute to the engineering advances incorporated in the design of this plant.

THE VULCAN COPPER & SUPPLY CO. CINCINNATI, OHIO

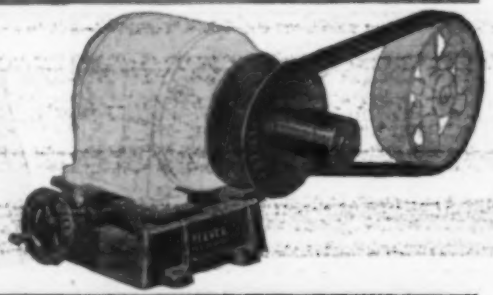
these 3 units MADE INDUSTRY SPEED CONTROL MINDED

REEVES VARIABLE SPEED TRANSMISSION

Provides infinite speed adjustability over wide range. Accurate at all speeds. Modern, compact open and enclosed designs, vertical and horizontal. Fifteen sizes—fractional to 87 h.p. Speed variations from 2:1 to 16:1 inclusive.

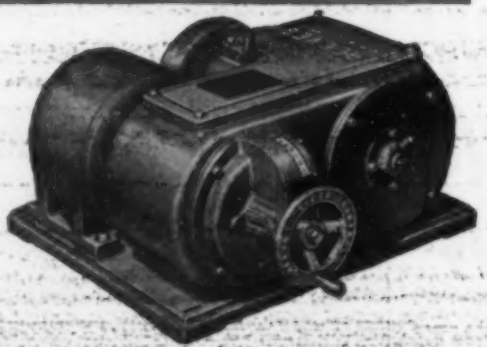
REEVES VARI-SPEED MOTOR PULLEY

Simplified development of transmission. Mounts on standard shaft of any constant speed motor. Forms actual drive to machine. Sliding motor base is moved forward or back for speed changes. Ten sizes—fractional to 15 h.p.; within 4:1 range of variation.



REEVES MOTODRIVE

Combines in one compact, self-contained enclosure, constant speed motor, REEVES speed varying mechanism and reduction gears (where required). Available in space-saving horizontal and vertical types—¼ to 15 h.p. Speed variations 2:1 to 6:1 inclusive.



Easily installed on any driven machine. For complete data, send for 96-page Catalog CM-450.

REEVES PULLEY CO., COLUMBUS, INDIANA

REEVES Speed Control

and J. M. Schlendorf vice president in charge of sales.

Westinghouse Electric Corp., Pittsburgh, has appointed Henry B. Ahlers assistant to Ralph C. Stuart, vice president in charge of the lamp division at Bloomfield, N. J. Dr. Albert Brann was named manager of the division's specifications and standards department and Paul B. Tully was appointed assistant manager of lamp manufacturing.

Link-Belt Co., Chicago, has placed A. C. Fellinger in charge of sales, power transmission machinery, with headquarters at the company's Ewart plant in Indianapolis. He succeeds the late C. Walter Spalding.

United Chromium, Inc., New York, has elected Richard O. Loengard president and Theodore G. Coyle and Hugh D. McLeese vice presidents. Messrs. Coyle and McLeese will continue as technical director and general sales manager, respectively. The company recently opened offices in Chicago and Dayton and plans to establish an office on the Pacific Coast.

American Maize-Products Co., New York, has transferred Dr. B. F. Buchanan, recently promoted to supervisor of research, from New York to Roby, Ind. Miss Martha Seastrom has been named assistant to Dr. Buchanan in the company's New York laboratory.

B. F. Goodrich Chemical Co., Akron, has promoted Paul C. Jones to the position of field technical manager. He had been serving as technical representative on chemical sales.

Kerotest Mfg. Co., Pittsburgh, has established an office and warehouse at 3311 East Slauson Ave., Los Angeles, with J. A. Swaton as district manager for steel valves and J. A. Norris district manager for the brass division.

General Alloys Co., Boston, has advanced L. J. Edwards from New England district manager to field manager working out of Boston and supervising field engineering and sales activities of the national organization. B. W. Bittner takes over Mr. Edwards' former duties.

Dow Chemical Co., Midland, Mich., has formed a new merchandising division for small package and consumer items with Sherman W. Putnam in charge. The new division is expected to concentrate on specialty insecticides and certain fabricated magnesium articles.

Pangborn Corp., Hagerstown, Md., has selected Howard E. Schellhase as district manager at Philadelphia to succeed Forrest G. Sharpe who died last June.

Aircraft Parts Development Corp., Summit, N. J., has changed its name to Hungerford Research Corp. This is in line with a broadening of activities to cover product and process development in all fields of industry. The organization has moved to its new laboratory in Murray Hill, N. J.

For Emergency Service

THE M·S·A RUBBERIZED

PROTECTION SUIT

- GAS PROOF
- LIQUID PROOF
- STRONG AND DURABLE

Complete body protection from head to toe against liquids and gases is provided by the sturdy, comfortable M.S.A. Rubberized Protection Suit, worn for all-around safety in meeting chemical plant emergencies. Where respiratory hazards are present, safe protection is provided when the Suit is used with the M.S.A. All-Service Gas Mask (right) or with the M.S.A. One-Hour Oxygen Breathing Apparatus (left). The All-Service Gas Mask is worn where any poisonous industrial gases—including Carbon Monoxide—are encountered, and where there is sufficient oxygen present to support life. In high concentrations of gas or where there is any possibility of oxygen deficiency, the One-Hour Oxygen Breathing Apparatus should be used.

Write today for complete details on this modern M.S.A. protection equipment!

CONSTRUCTION DETAILS

The M.S.A. Rubberized Protection Suit consists of a suit and hood—available separately—made of heavily rubberized, black, double-texture material, hand doubled, stitched, cemented and strapped at all seams, and then vulcanized to assure waterproofness. The gloves and boots are permanently attached to the suit. Available in Small, Medium, and Large sizes.

MINE SAFETY APPLIANCES COMPANY

BRADDOCK, THOMAS AND MEADE STREETS · PITTSBURGH 8, PA.

District Representatives in Principal Cities

In Canada: MINE SAFETY APPLIANCES COMPANY OF CANADA, Ltd.

TORONTO, MONTREAL, VANCOUVER, CALGARY, NEW GLASGOW, N.S.

WATER SYSTEMS

—For Peaceful Cities and Busy Industries

Waiting days are over! You can NOW go ahead with new building and expansion plans for a bigger and better Water System—a Layne Well Water System that will operate with the utmost efficiency—produce greater quantities of water at the lowest of all in power cost.

Layne will need no time for conversion! The entire factory and all Layne Affiliated Companies with their drilling and installation crews are ready — and now are in action building Well Water Systems for all types of industries, cities, villages, mines, and irrigation projects.

You will want your new well water system to embody the many outstanding and exclusive Layne features. You will want the Layne ruggedness of quality that insures longer life and the Layne unmatched high efficiency for low operation cost.

Better write—or wire for full details of Layne's all inclusive Well Water Development service. For catalogs, address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

LAYNE PUMPS *— fulfill every need for producing large quantities of water at low cost from wells, streams, mines or reservoirs. Send for literature.*

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis, Tenn. * Layne-Northern Co., Mishawaka, Ind. * Layne-Louisiana Co., Lake Charles, La. * Louisiana Well Co., Monroe, La. * Layne-New York Co., New York City * Layne-Northwest Co., Milwaukee, Wis. * Layne-Ohio Co., Columbus, Ohio * Layne-Texas Co., Houston, Texas * Layne-Western Co., Kansas City, Mo. * Layne-Western Co. of Minnesota, Minneapolis, Minn. * International Water Supply Ltd., London, Ontario, Canada * Layne-Hispano Americana, S. A., Mexico, D. F.

LAYNE

WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS

CONVENTION PAPER ABSTRACTS

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RESEARCH REDELOYMENT

RESEARCH during the next few years will be the most essential activity in industry. The assignment of a research organization is to survey the whole field of science to find out what is of value to a company's business and the whole field of a company's business to see where it needs the application of science.

The possibilities of putting atomic energy to work, of further application of electronics, of catalysis and particularly the fluid technique in catalysis, of developing gas turbines and jet propulsion are examples of the challenges petroleum researchers face today.

Research should begin on its own doorstep by investigating whether its own methods are of the best, because it has a monumental job ahead to be done with a relatively thin line of personnel. War research workers face a problem of swift redeployment. They will have to be fast on their feet and determined to keep the company moving forward in both methods and the products turned out.

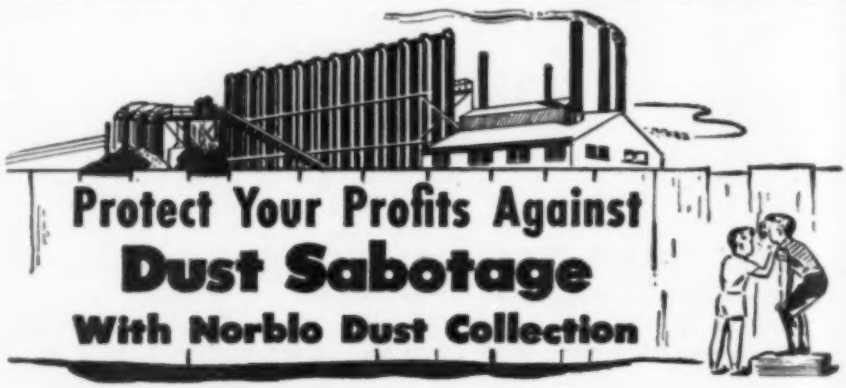
R. E. Wilson, Standard Oil Co. (Ind.), before the company's third joint technical meeting, Chicago, June 18, 1945.

PROSPECTS FOR RARE METALS IN INDUSTRY

RARE metals whose names are now almost unknown to the general public may, in the future, become as familiar as magnesium, molybdenum, and aluminum—all of which have risen from obscurity in the past half century.

Titanium and zirconium may become familiar as substitutes for stainless steel. Only 15 years ago was a method perfected for obtaining these metals, together with hafnium, on a commercial scale. Titanium is regarded as having special promise since its ores are available in almost unlimited quantities. Zirconium is useful as an alloy of copper. Such alloys containing only 7 percent zirconium have twice the strength of copper.

Other rare metals finding increasing use include rubidium and caesium, both of which give photo-sensitive layers for definite wave lengths. Caesium cells are an important factor in recording sound for



Protect Your Profits Against Dust Sabotage With Norblo Dust Collection

ENGINEERED control of dust nuisance compares with guess-work systems as the modern vacuum cleaner compares with the old fashioned broom in good housekeeping. The only sensible, economical way to control and collect fume or dust is to control and collect as much of it as possible.

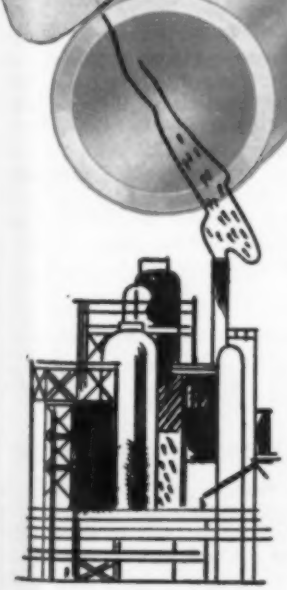
Norblo automatic bag type equipment in some fume and smelter installations pays for itself within a few months. In any Norblo engineered installation you get advanced design insuring long life, slowest obsolescence, high efficiency and guaranteed performance. Norblo equipment includes also centrifugal and hydraulic types. Write for descriptive folders to help you make a preliminary survey of your needs—or tell us your problem.

Norblo

THE NORTHERN BLOWER COMPANY
6411 BARBERTON AVENUE CLEVELAND 2, OHIO

USE TIMKEN SEAMLESS TUBES of THESE STEELS TO SOLVE HIGH TEMPERATURE PROBLEMS

CARBON STEEL
Generally used for service at temperatures not exceeding 900°F. where corrosion and oxidation resistance are not important.
CARBON-MO STEEL
For temperatures up to 1000°F. the satisfactory creep strength allows for greater safety than can be obtained from carbon steel.
DM STEEL
For service up to 1150°F. this steel offers outstanding creep strength.
2% CR 1/2% MO STEEL
For service up to 1150°F. where intermediate corrosion resistance is desired in combination with good creep strength and fair oxidation resistance.
SICROMO 2 STEEL
For service up to 1200°F. where better scale resistance is required than can be obtained with 2% Cr. ½% Mo. steel.
2¼% CR-1.0% MO STEEL
For service up to 1150°F. where a greater resistance to creep is desired than that possessed by the 2% Cr. ½% Mo. steel.
SICROMO 3 STEEL
For service up to 1200°F. the excellent oxidation and good corrosion resistance of this material justifies its choice as a substitute for 4-6% Cr. ½% Mo. steel.
4-6% CR-MO STEEL
For service up to 1200°F. where corrosion resistance is a primary requirement. Corrosion resistance somewhat superior, but oxidation resistance less than Sicromo 3.
SICROMO 6 S STEEL
For oxidation resistance up to 1500°F. Good creep strength, corrosion resistance and structural stability up to 1300°F.
SICROMO 7 STEEL
For those applications where better corrosion resistance is required than can be obtained with the 5.0 per cent Chromium type steels.
SICROMO 9 M STEEL
This steel possesses the maximum corrosion resistance of any of the steels below the stainless group.
18-8 STEEL
This austenitic, non-magnetic alloy shows the best combination of creep strength, oil corrosion resistance and oxidation resistance for service up to 1500°F.



Secure maximum tube life per dollar invested by installing Timken Seamless Tubes made from the steels listed above. They offer you a wide choice of material to combat the severe operating conditions encountered in producing fuels of greater efficiency.

Most of these steels are the results of a 17 year old research program carried on by The Timken Roller Bearing Company. They have remarkable strength at elevated temperatures and offer stubborn resistance to heat, corrosion and oxidation. As a consequence they have been used by refiners in all parts of the world to solve some of the most difficult high temperature problems.

Timken Seamless Tubes can be installed rapidly because they have good weldability and are supplied in the annealed condition to permit all the usual cold forming operations.

Check over the above list. Pick out the steel that fits your particular problem. Then when you build new equipment or make replacements specify the analysis you have chosen. The results will be longer tube life, less downtime and greater profits. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

For complete information on the steels listed, write for Technical Bulletin No. 20, "A Guide For Users of High Temperature Steels".

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
SEAMLESS STEEL TUBES

● Here's a ready solution to most venting problems . . . including the problem of high installation and maintenance costs!

Use easy-to-handle Corrosion-resistant Transite 'S' Pipe for vents, ducts and stacks

Made of asbestos fiber and cement, Transite 'S' Pipe gives effective and economical service in venting most fumes, vapors, dusts, gases, etc. in industrial operations. It is highly weather-resistant . . . cannot rust.

In addition to being strong and durable, Transite 'S' Pipe has a smooth interior surface and relatively low-heat conductivity.

J-M Transite 'S' Pipe is made in 19 sizes: . . 2″ to 7″ diameters in 10′ lengths, 8″ to 36″ diameters in 13′ lengths. A complete line of fittings is available in the many sizes and shapes required for complex venting installations.

To obtain complete information, write today for data sheets DS Series 336. Address Johns-Manville, 22 East 40th Street, New York 16, New York.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE 'S' PIPE

the movies. Milligrams of barium, one of the most active metals, help give radio tubes their present long life. Tantalum is almost indispensable in the large power tubes used in radios. Indium, in very small amounts, decisively improves the corrosion properties of the cadmium bearings used in airplanes.

Columbium has a fine yellowish color and may one day be used for jewelry and tableware. Currently, it is employed chiefly in welding rods for stainless steel used in making chemical equipment. Selenium makes some super-rubbers in substitute for sulfur and also is used as a glass de-colorizer and in photocells and rectifiers. Tellerium gives lead a finer grain and greater stiffness in alloys. Rhenium, which is associated with molybdenum and manganese minerals, is of interest to lamp manufacturers because of its very high melting point of 3,200 deg. C.

Vanadium is better known than most of the rare metals since it is an important alloy of certain steels. Although scientists have been able to produce pure vanadium for a century, it is still one of the rarest metals and the world supply was only about 350 tons a year prior to the war.

Boron, a metalloid, is available in vast quantities, but is one of the least studied of the rare elements. It is an extremely hard element and is used in ferro-alloys. Boron carbide is the hardest material after the diamond and a few years ago was placed on the market as an abrasive, for use in the nozzles used in sandblasting, and to replace jewels in watches. The most important uses for boron is for compounds produced by the chemical industries for softening water, as fertilizer, for timber preservation, and as a fireproofing agent.

Also on the long list of little known metals are lanthanum, yttrium, gallium, indium, thallium, germanium, gadolinium, uranium, thorium, strontium, and beryllium. Further research on all these metals will be required before they can leave the "rare" category, if at all.

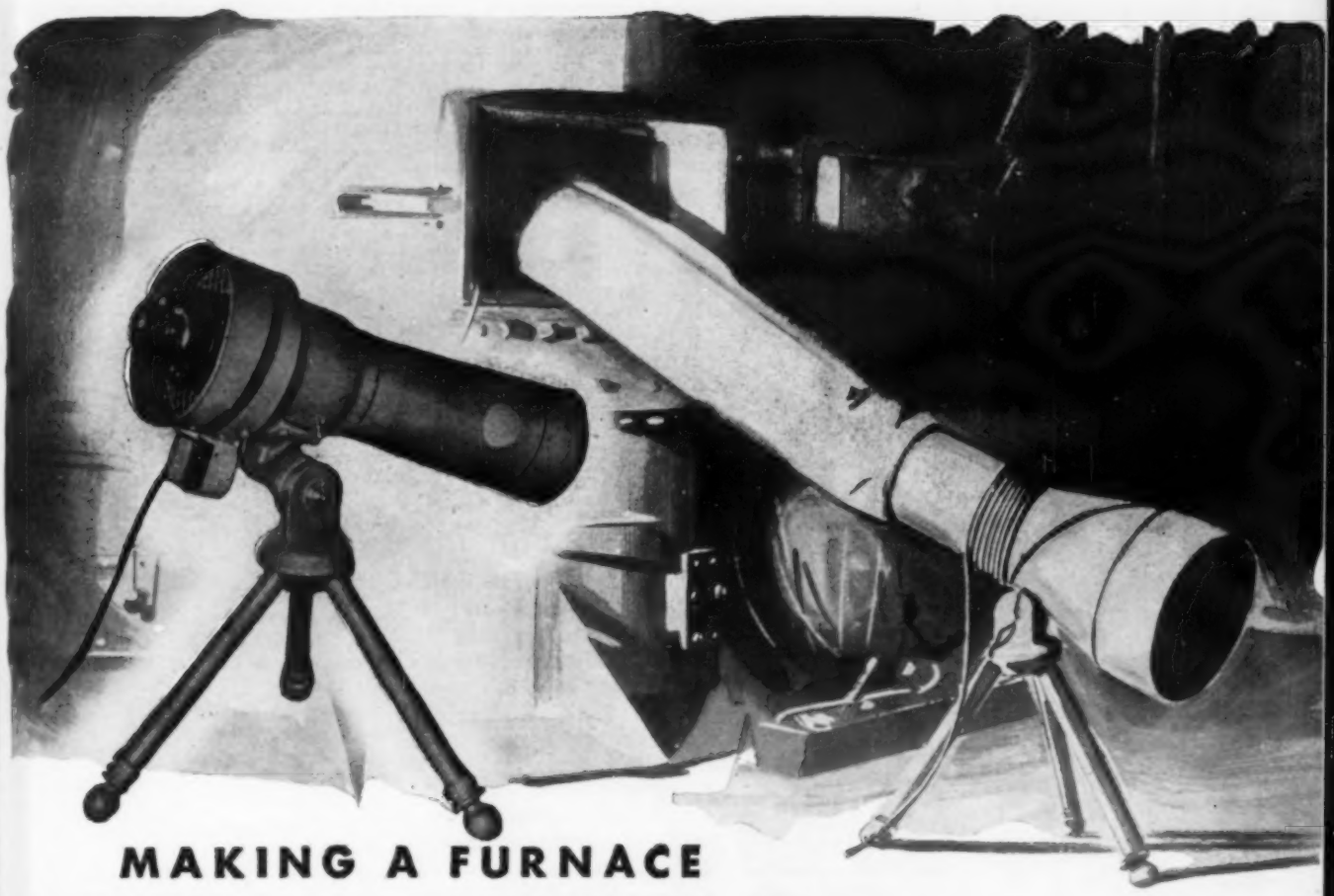
A number of the so-called rare metals probably could be made available by the hundred thousands of tons a year if sufficient research could be done to perfect methods of extraction and to develop new uses.

W. J. Kroll, Bureau of Mines Electrode-velopment Laboratory, before Portland chapter, American Institute of Mining and Metallurgical Engineers, Portland, Ore., June 1, 1945.

CHINA'S MINERAL RESOURCES

After centuries of wandering in the wilderness of classical thinking, China has at last come into her own in the realm of science and technology for her mineral development. The hoary notion that China is a great treasure house of minerals is glaringly erroneous. Investigations carried out in recent years by the Chinese Geological Survey have discounted the rosy view. However, the mineral resources of China so far known may be considered adequate for the building of her industrial structure after the war.

The coal resources of China are more than sufficient for the country's needs in her postwar industrialization. The iron ore



MAKING A FURNACE A BETTER PLACE TO LIVE IN

When a furnace or anything in a confined space needs attention, a Coppus Blower will make the interior livable in a short while, reducing down time.

From the Coppus "Blue Ribbon" line of blowers and exhausters, you can find exactly the right ones to help you save time and improve working efficiency on jobs where confined spaces must be cleared of fumes or foul air . . . where heat exhaustion threatens . . . where equipment or material in process needs to be dried. There are Boiler Manhole Blowers and Exhausters, Cable Manhole and Tank Ventilators, Shiphold Ventilators, Heat Killers and other types—all designed to put the right amount of air where you want it, at lowest cost.

The blue band painted around each Coppus product signifies "Blue Ribbon" materials and workmanship, promising you long trouble-free service despite the severe usage such portable equipment gets.

For specific information check and mail the coupon. Address Coppus Engineering Corporation, 229 Park Avenue, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP., 229 PARK AVENUE, WORCESTER 2, MASS.
Please send information on how to plug Man-Hour Losses with air.

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting, welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.

NAME.....
COMPANY.....
ADDRESS.....
CITY.....

(Write here any special ventilating problem you may have).

Another Chemical Problem tackled—*and solved* by an "N.F.E."*

NIAGARA HANDLED THIS FILTRATION HOT!

ABOVE . . . A No. 200 typical steam-jacketed NIAGARA Filter with 15" x 10" quick-opening cake removal door, vacuum receiver for cake washing, and discharge check valve. This filter is standard equipment for vegetable oil miscella clarification.

INSERT . . . Diagrammatic sectional drawing of Niagara Filter illustrating how simply and effectively a two-thirds jacket is applied.

PROBLEM:

Could Niagara keep it hot—and filter it at the same time?

You bet we could—

AND WE DID!

It happened to be molton wax in this instance, but it could have been any one of a dozen similar chemical products which must be kept hot during filtration to decrease viscosity, promote high flow rates and economical filtration. It could have been vegetable oils, magnesium sulfate, potassium chlorate, sodium tetraborate, glue, liquid soap or any of the many organic and inorganic salts which "freeze", crystallize, harden—get like "molasses in January" — at normal temperatures.

● Niagara Filtration Engineers solved the problem by JACKETING the Niagara Filter System! Niagara Filter Systems, because of their tank-type design and construction, are perfectly suited to complete or partial JACKETING—maintaining and controlling any specified temperature (thermostatically, if desired) — high or low.

● A jacketed Niagara Filter System can be heated with steam, Dowtherm or hot water (or cooled by brines, ammonia or cold water depending on the character of the product), and all areas are evenly heated (or cooled). Jackets are easily insulated to protect the operator.

● No other type of filter can match a Niagara for such an application. It's a "hands down" logical choice. If your product will filter better or faster *hot*—call in an N.F.E.*

Are Sugar Substitutes Troubling You?

Niagara Filtration Engineers are ready to give you real help on this current problem. By a simple, engineered treating-and-filtering procedure, and N.F.E.* can recondition, clarify, decolorize and deodorize such materials to meet Pure Food Act requirements. Samples processed without obligation.

JUST OFF THE PRESS!

The two-color eight-page booklet telling the story of Niagara Filter Systems for the Chemical, Food, Fermentation and Process industries. It's yours free . . . write for Bulletin G-345.

"N. F. E."*.

Niagara Filtration Engineer . . . a trained, graduate engineer with years of actual field experience in filtration problems of all kinds. The "know-how" of Niagara's staff of N.F.E.'s is attested by the highly efficient performance of every Niagara Filter Installation. This staff is at your service . . . at all times . . . at no cost or obligation.

niagara filter CORPORATION

3090 MAIN STREET AMherst 1510 BUFFALO 14, N. Y.

Canadian Affiliate—Niagara Filter Corp. (Canada) Ltd.

resources, although less abundant, are adequate to support a steel industry. The country is self-sufficing in manganese and bauxite. In tungsten and antimony China is the world's largest producer. Tin and mercury exist in exportable amounts. China is very poor in lead and zinc and comparatively poor in copper and petroleum.

China can be roughly divided into three metallogenetic provinces: North China, the Yangtze Valley, and South China. In North China the old pre-Cambria schists and gneisses are represented by the abundance of quartz mines in which sporadic occurrences of copper, lead, zinc, gold and silver are sometimes found in subordinate quantities; along the Yangtze Valley and Central China are found here and there occurences of intrusions of dioritic rocks, in which occur the famous contact deposits of iron ore, in addition to minor quantities of copper, lead, and zinc; in South China the igneous intrusions are of granitoid type in which, or in the vicinity of which, occur in certain regions immense deposits of antimony, tungsten, tin, and mercury. Broadly speaking, most of the famous coal mines are now situated in regions north of the Yangtze, in which occur also the sedimentary deposits of iron in contradistinction to the contact deposits of iron along the Yangtze Valley.

The hinterland of China may be called the wild west of China. Under the impact of the war this part of China has become known to possess some sizable mineral deposits. Just witness the recent discoveries of oil in Kansu, bauxite in Kweichow, and copper in Yunnan.

An analysis of China's mineral resources points clearly to their adequacy for the creation of an industrial nation. True, in view of her shortcomings in certain mineral resources, China cannot rival the United States in mineral production. However, as China's mineral resources are more comparable to those of Soviet Russia and as Soviet Russia has during recent years passed through successive stages of industrialization, a patterning after Russia in fitting in the estimation of China's future production in minerals.

With her past experience in coal mining it would be feasible for China to attain to the requisite production which is a little above the proposed production. However, with regard to steel, cooper, aluminum and petroleum, due to the lack of technical background and to the shortcoming in some of her resources, China at the initial stage may do well to confine herself to the proposed productions which, with the exception of petroleum, are about one-fourth of the requisite productions.

C. Y. Wang, before New School for Social Research, New York, April 26, 1945.

THREE KINDS OF CARTELS

IN RECENT years there have been various pressures undermining our competitive enterprise system and pushing us toward a collectivist system under ever expanding governmental authority. The widespread movement that recently has come to the front to cartelize world trade under government control through so-called "trade accords" is the greatest danger now threatening economic progress in America.

Business and industry render their

Photo courtesy Lockheed Aircraft Corp.

STROKE OF *Lightning* IN THE SKY

... RIDING ON LUNGS OF SPECIAL ALLOY STEEL

FOR the superior high-altitude performance of the Lightning and other first-line American warplanes, give primary credit to their engine "lungs" —the GE Turbo-Supercharger—a milestone in research and design, and a triumph in metallurgy and production.

Allegheny Ludlum collaborated on turbo-supercharger research for years before the war. Our chief contribution was the development of a commercial technique to centrifugally cast the supercharger diaphragm—an intricate shape which was formerly laboriously fabricated by welding. This casting, made of a highly complex alloy steel which maintains its strength at red-hot temperatures, was much stronger, more durable and more efficient than the fabricated article. And, even more important, the way had been opened for quantity production.

Already, in gas turbine work and other directions, these developments are bearing additional fruit. Just remember that the function of Allegheny Metal and our other special steels is either to do the thing that once seemed impossible, or to do better what is already being done. Let us help you apply these materials to *your* needs for improved service in the face of heat, wear or corrosion.

Allegheny Ludlum Steel Corporation
Brackenridge, Pennsylvania

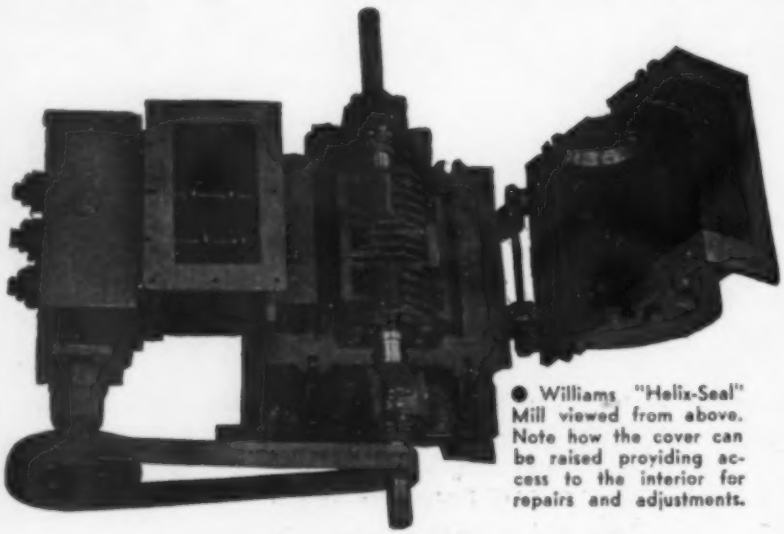
ALLEGHENY METAL
The Time-Tested Stainless Steel

W&D 9494-D

ALSO HANDLED AND STOCKED BY ALL JOSEPH T. RYERSON & SON, INC. WAREHOUSES

Williams
OLDEST AND LARGEST BUILDERS OF HAMMERMILLS IN THE WORLD
PATENT CRUSHERS GRINDERS SHREDDERS

"HELIX-SEAL"
PULVERIZERS



● Williams "Helix-Seal" Mill viewed from above. Note how the cover can be raised providing access to the interior for repairs and adjustments.

• • GRIND WET OR STICKY MATERIALS
• • FINE GRIND—100 TO 325 MESH
• • NO OUTSIDE SEPARATION NECESSARY
• • INEXPENSIVE TO INSTALL

• The Helix-Seal Mill grinds extremely fine, without the aid of outside separation. This is largely due to the long grinding surface, adjustable grinding parts and high speed of the hammers. Due to the screw feeder, which acts both as a feeder and seal, sealing the intake opening against the in-rush of air, no air is sucked into the machine and consequently there is no resulting dust carrying draft expelled from the discharge. Built in nine standard sizes, capacities 200 pounds per hour and up.

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greatest service to the nation when they constantly produce better products and services at lower prices through an efficiency that reconciles a low cost policy with the payment of high wages. But that objective can be realized only through constantly increasing the productive efficiency of everyone engaged in business and industry. It cannot be achieved under the restrictions of bureaucratic control; nor can it be achieved in the face of feather-bedding practices, whether imposed by government, labor or the owners of industry; and it cannot be achieved if we are going to adopt policies that remove both the stimulus and the means to increased efficiency by reducing alike the rewards for seeking it and the penalties for ignoring it.

The word cartel means an arrangement whereby two or more independent enterprises undertake to restrict the production, fix the prices, and/or allocate markets or sales quotas covering commodities in which they trade. This is the so-called private cartel.

A government-controlled cartel is such an arrangement under the direction or with the sanction of the government having jurisdiction over such enterprises and it usually contains provisions for the enforcement of the arrangement.

A super-state cartel is an arrangement requiring independent enterprises to restrict production, fix prices and/or allocate markets, made pursuant to an international agreement or treaty between two or more governments which undertake in some manner to enforce upon their nationals the terms and conditions of such an arrangement.

The private cartel embraces monopolistic practices in restraint of trade that have been outlawed in this country for more than 50 years. The evil and reprehensible nature of such practices is beyond dispute. Their effect has been to destroy initiative, close the door of opportunity for new individual entrepreneurs; destroy small business units; encourage inefficiency; raise prices and thus lower the standard of living. These fruits of the cartel system result in the freezing of industrial progress to the detriment of workers, consumers and those with saving to invest.

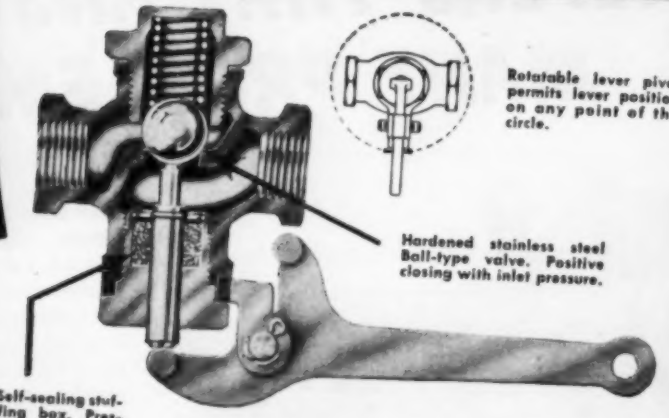
Few voices today are openly raised in defense of the so-called private cartel. But there is a school of thought which believes that an undertaking which is against the general welfare, and thus bad, can be made good if it is conducted under government control. Such euphemisms as "orderly development"; "stabilization"; "fair competition"; "rationalized competition"; "elimination of waste" and "fair prices" always are used to describe the objectives of a cartel. They are terms which should immediately arouse suspicions.

A healthy foreign trade is essential to our well-being as well as that of the rest of the world. Our government should be vigilant in opening and preserving trade opportunities abroad for American business and every effort, compatible with our national interest, should be made to expand world trade. Our volume of world trade, proportionately small as it has been, is of great importance to our economic life, particularly to those industries largely dependent upon export business. But this foreign trade is not worth the price, if that

Will this valve simplify many control problems?

INVESTIGATE THE MANY POSSIBLE APPLICATIONS OF THE LESLIE

TRADE MARK REG. U. S. PAT. OFF.


Rotatable lever pivot permits lever position on any point of the circle.
Hardened stainless steel Ball-type valve. Positive closing with inlet pressure.
Self-sealing stuffing box. Pressure-sealed during flow.

TYPE BA AIR OPERATING VALVE

quick—acting

AIR-OPERATING VALVE

TYPE BA VALVE

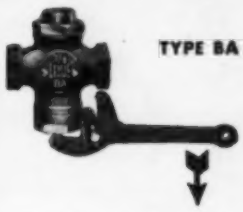
This self-sealing, ball type, air operating valve can be opened or closed instantly from almost any position and has a wide field of use in industry. They are made with cast iron bodies, integral seating surfaces, screwed connections, and in sizes ¼", ⅜" and ½". The type BA valve is fitted with a hand opening lever and a rotatable pivot so that the lever can be located in any position and opened with either horizontal or vertical pull. Operating pressures up to 200 p.s.i. are recommended. The ball type valve offers many advantages and will not collect dirt or foreign matter, closes with the inlet pressure and always finds a tight seat. The stuffing box is not accessible to tampering or adjustment and is self-packed by the operating pressure when the valve is open, permitting flow.

TYPE BAC VALVE

The Type BA valve can be fitted with a cam operated lever (Type BAC) permitting instantaneous valve opening or closing by throwing the lever in the desired drection. The cam construction holds the lever in the position thrown until returned manually to the original position. The yoke supporting the lever can be rotated around the valve bonnet to any desired location. Enlarged lever end provides easy visual check on inner valve position.

TYPE BA

Showing lever in position for parallel pull



TYPE BA

Showing lever in position for right-angle pull

TYPE BAC

Showing Cam-type Indicating lever raised—valve open

TYPE BAC

Cam-type Indicating lever down. Valve closed

YOU CAN BUY THIS VALVE FROM THESE AGENTS

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DETROIT 26, MICH. Lloyd R. Leatherman
HOUSTON 2, TEX. Gulf Engineering Co.
KANSAS CITY 6, MO. Mooney Eng. Co.
LOS ANGELES 15, CAL. Adolf Fresse Corp.
LOUISVILLE 2, KY. John Zimmerman
NEW ORLEANS 13, LA. Gulf Engineering Co., Inc.
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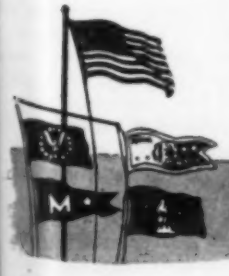

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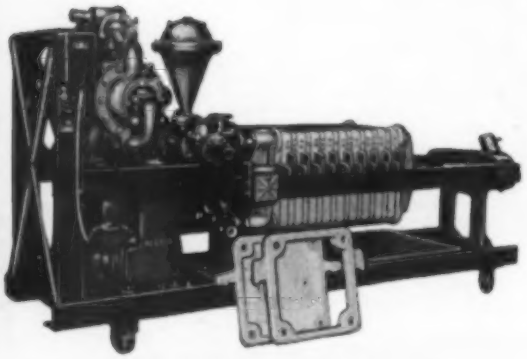
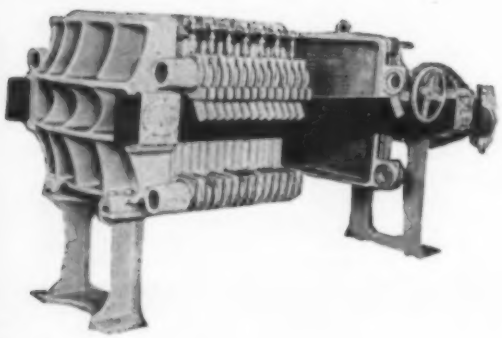


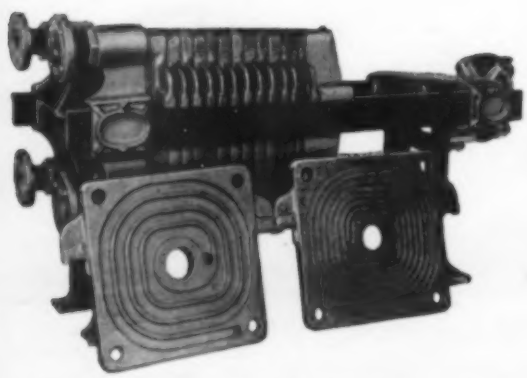
Portable Shriver Filter Press, with rubber washing type filter plates and frames, for corrosive slurry containing quick settling solids, connected to rubber-lined Shriver Diaphragm, driven by variable speed drive.

•



Shriver Stainless Steel Filter Press, side feed, closed delivery, washing type equipped with visible discharge fittings and shut-off valves permitting quick examination of filtrate and shut-off of any filter chamber.

•



Shriver Continuous Thickener with synthetic rubber-covered iron plates and frames for rapid thickening and washing of corrosive, slow settling material; reduces thickening time and space required for equipment.

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Many other Shriver units designed to meet specific filtration problems related to process and product are illustrated in the new catalog No. 45. They may apply to your particular project. Write to T. Shriver & Company, Inc., 802 Hamilton Street, Harrison, N. J.

SHRIVER FILTER PRESSES

price is abandonment of our competitive enterprise system and placing our domestic economy in a totalitarian strait jacket.

Assume that we must live in a world which outside our borders is wedded to the cartel system. Then we should use our great economic power to give world leadership and direction toward a more universal adoption of the competitive enterprise system.

Again, why should not Congress enact legislation making it unlawful for America to lend money to foreign enterprises participating in cartel arrangements. Such action would apply to foreign loans the prudence and common sense exercised at home by bankers against lending to enterprises engaged in practices destructive of their markets.

Let us not be beguiled by emotional appeals and glittering promises, but let us give sober reflection to the recent observation that "No people ever entered the compulsory state through a door on which the price of admission was plainly posted." Through the doors of super-state and government-controlled cartels lies the road that leads to Nationalism, Isolationism, Totalitarianism, and finally, to another disastrous war.

J. Howard Pew, president, Sun Oil Co., before National Conference of Business Paper Editors, New York, March 19, 1945.

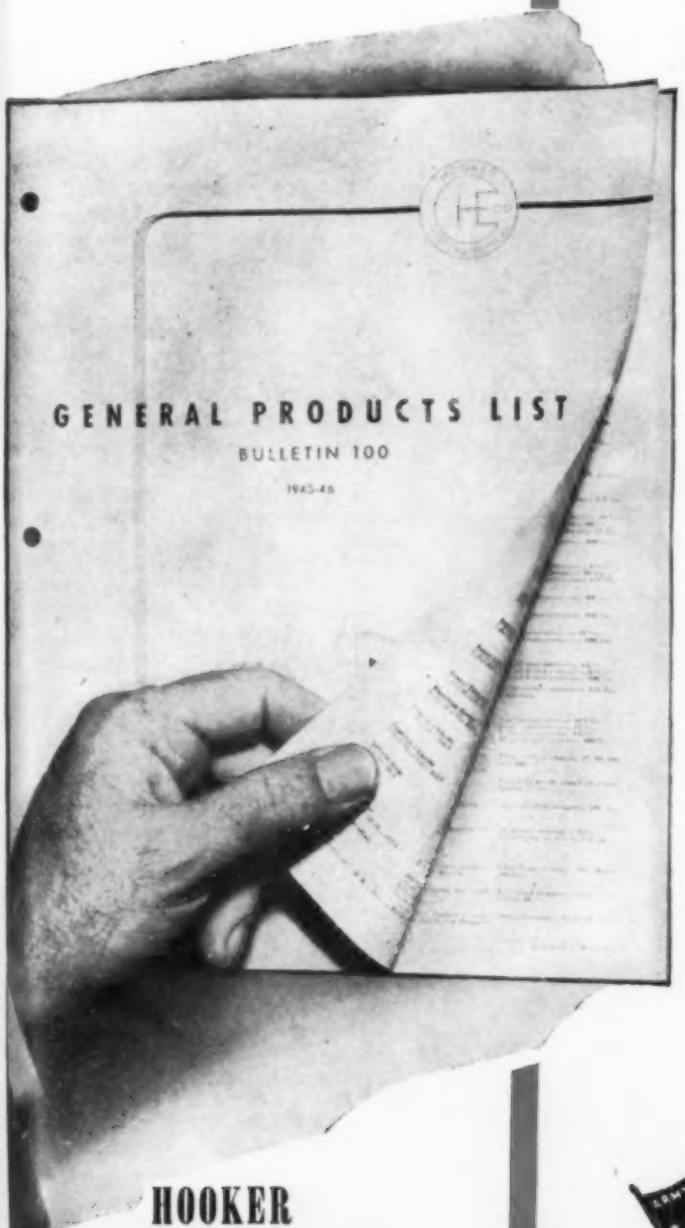
ENGINEERS AS PROFESSIONAL MEN

In the United States the engineering profession has never had its due social and economic recognition. The value of the works of the engineer have long been recognized, but the responsible party, the engineer, has had little acclaim. The creator has been lost sight of in this creation. To a very great extent engineers themselves are to blame for this condition. As a class, engineers are prone to be content to busy themselves in their laboratories or with their design problems. They are content to get what enjoyment they can in dealing with inanimate things; studying and testing their properties devising uses for them in terms of stress, thermal properties, electrical properties, chemical properties, etc. Behaviors that can be predicted by mathematical and chemical equations are more alluring to many engineers than dealing in human relationships where reactions are more complicated and to a greater extent unpredictable. Engineers by the nature of their work tend to become individualists, forgetting that professional development requires group thinking and group action. In other words, engineers have lacked, and some still lack, professional consciousness.

The first law for the registration of engineers was enacted in 1907. Today 46 states have laws requiring registration of engineers as a legal qualification to practice. True some of these laws are weak, some cover only structural engineers, and practically all of them have too many exemptions from the provisions of the act. It is encouraging that, in several states, plans are under way to strengthen their engineering registration laws.

Some non-professionally minded engineers are inclined to look upon registration as a magic medium for immediately in-

Seven New Chemicals Have Been Added to Hooker's General Products List



What is the boiling range of Hooker Monochlorbenzene? What is the chlorine content of Hooker Sulfur Dichloride? Is Lauryl Chloride a liquid or solid and what are some of its uses? In what size containers is Hooker Cyclohexanol shipped?

This is the type of information you will find in the new edition of the Hooker General Products List of nearly 100 Chemicals. Seven of these are new developments making their first appearance among the other Hooker Products.

A copy of this new bulletin which gives descriptions, principal specifications, uses and shipping information will save you time and trouble in selecting chemicals for your requirements.

When in need of chemicals, make it a habit to look at the Hooker General Products List. In that way you can be sure of the uniform high quality and purity that have been pleasing users for years. Technical Data Sheets and samples of products in which you are interested will be sent on request. Our Technical Staff will be glad to assist in the application of chemicals to your particular problems.

Take the first step in getting acquainted with Hooker by sending for this new edition of our General Products List.

Just type your name and "Bulletin 100" on your letterhead and a copy will be sent to you

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Paradichlorbenzene	Chlorine	Sodium Sulfhydrate

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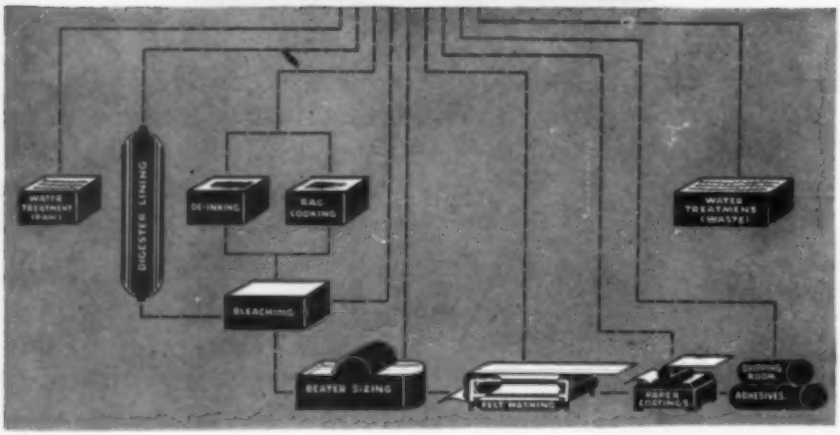
Not one, BUT NINE

PAPER MILL USES FOR PQ SILICATES



How many can you name? In each of the following steps in the manufacture of paper, a PQ Silicate improves the result or lowers the cost. Often it does both. The properties which prove so useful to paper mills may suggest new possibilities in your operations.

1. Silica sol coagulant aids (made with N Brand) remove color from fresh water supplies, also clarify white waters.
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4. Rag cooking utilizes Metso's effective detergent action. Results: better color removal, high final fibre strength.
5. Pulp bleaching (chlorine or peroxide). Brightness increased. Finished quality improved.
6. Silicate sizing in the beater improves the finish, increases tear and bursting strength of the sheet.
7. Felts washed with Metso are more absorbent and last longer.
8. Coatings for paper. PQ Silicates deflocculate clays. Silicate films greaseproof paper board.
9. Packaging adhesives. Silicates are odorless, quick-drying, form strong bonds for sealing the ends of paper rolls and paper board shipping cases.

Keep posted on silicates of soda. Read "Silicate P's & Q's", monthly message to those who use or could use silicates. Mailed free on request.

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PQ SILICATES OF SODA

creasing earning power. Those who have this conception, are doomed to disappointment. Registration of engineers does not, per se, increase salaries or produce higher fees. Registration is continually improving the appreciation of our profession through better public relations, improved ethical concepts and practices, higher qualifications for practice, and reduce incompetency. The effect of these has resulted in increased fees and salaries in many instances.

A number of the state societies of professional engineers have published what they consider fair schedules of minimum engineering fees and salaries. There is plenty of evidence to show that these schedules are effective and bring results. In at least one case they have resulted in a revision of the state schedule of salaries for engineers in civil service and, in several cases, in an upward revision of salaries of engineers employed by cities. Obviously, such schedules to be effective, must be fair and reasonable.

Registration of engineers is, and can only be, justified as a measure to safeguard the public against the dangers of incompetent and dishonest practice of engineering. The development, passage and enforcement of registration laws require collective action and study by engineers, which leads to beneficial results to the profession and the professional man through higher technical proficiency, more ethical practice, better cooperation within the profession and between the professional man and his client or employer, better appreciation of the profession by the public, and the secondary result of better compensation for the professional man.

H. E. Nold, mining engineer, Ohio State University, before Miami Valley Chapter, American Institute of Chemists, Columbus, Ohio, May 11, 1945.

WARTIME COOPERATION IN INDUSTRIAL DEVELOPMENTS

THE HISTORY of OPRD projects indicates that individual initiative was greatly intensified and problems were solved much more quickly whenever we had extensive cooperation among research organizations. This was particularly true when the problem involved was one of interest to many organizations, that is, a fundamental problem in which each and everyone was actively engaged.

There are those who felt that quite the opposite would occur—individual initiative would be stifled and individual efforts of a single laboratory or research organization would be less effective after this cooperation began. This idea is apparently based on the supposition that a research man is supposed to work best when all the ideas are his own. There might have been a time when this supposition was true and when developments were in the hands of lone inventors or small groups of research and development men. Today, however, we recognize that no great development is the product of a single individual or a relatively small group of men.

Cooperation of this type is readily obtained during these days of stress when the need for new development for the protection of our country is evident to all, and especially to the technical world. The

Five Typical Applications for one type

PROCTOR AEROFORM DRYER

All results of PROCTOR RESEARCH

PRECIPITATED CALCIUM CARBONATE

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WHITE LEAD

ZINC OXIDE

These five chemicals are typical of the materials being dried in large scale commercial installations of the Proctor Aeroform Dryer, with the automatic Fin Drum Feed.

With this continuous system, the material to be dried is delivered to the hopper of the fin-drum feed in a wet-solid state, after filtering or some other means of mechanical dewatering. The material, in this wet-solid state, is pressed, by means of rollers, into the grooved surface of the internally heated, revolving fin drum which forms the feeding device for the dryer. In this way, the material is dried sufficiently to be discharged, from the drum, to the conveyor of the dryer, in the form of small sticks—of uniform thickness. Circulation of heated air *through* the bed of pre-formed sticks on the moving conveyor, makes possible rapid, uniform and thorough drying.

In each case where one of these drying systems is in operation, it is the direct result of Proctor research. Before being installed, it was determined in the laboratory, that this was the system most ideally suited to the product to be dried. Every step in the development of the system was taken with consideration for how it would effect the ultimate operation of the system.

Because of the accurate findings of Proctor research engineers—it was possible, in each case, to guarantee the performance of the system. The five chemicals named are typical of those being dried efficiently in only one type Proctor dryer. If drying is a part of your manufacturing process—let Proctor engineers consider your needs. Their recommendations may well save you hours of production time and reduce your costs materially. The system they recommend will be "tailor-made" in every respect to meet your product or plant requirements.

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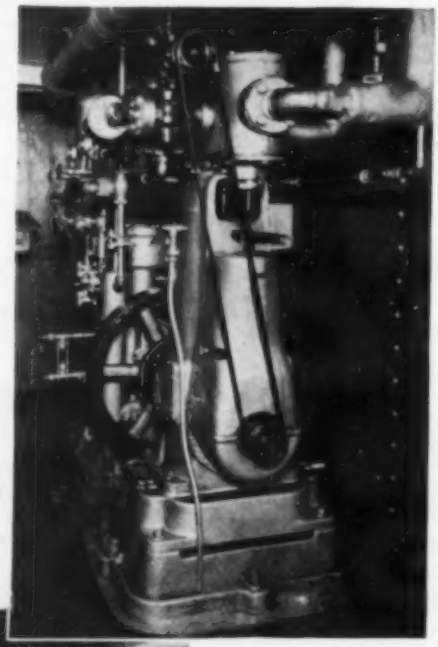
Improved designs of stokers and boilers are helping plants offset rising fuel and labor costs in steam generation, but that is not the limit to which economies can be carried. In most plants where steam is generated for processing purposes another important saving can be made by utilizing By-Product Power in the steam.

In many cases, steam passes through a pressure reducer before passing to its ultimate destination. To obtain By-Product Power pass the steam through a Troy-Engberg Steam Engine, instead of the pressure reducer. The power thus converted can be used to drive generators, stokers, compressors, ventilating systems and many other types of equipment. Power savings thus effected will quickly pay for your Troy-Engberg Engine—in some instances in as little as six months.

Ask for Troy's recommendations in your own set-up. There is no obligation, of course.



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TROY ENGINE AND MACHINE CO.

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ambition of the average research and development expert is to accomplish creditable results and he is usually thoroughly familiar with the fact that individually he can do more if he has unrestricted cooperation with his colleagues. It makes no difference whether a research man is located in an academic or an industrial laboratory, his attitude is always the same. In wartime the great incentive to accomplish results exists and financial considerations and even personal prestige become secondary matters.

All our scientists and engineers need is an incentive and they are willing to give their utmost, many times without remuneration of any description. They must believe in the cause. Once they believe in the cause, all they ask is an opportunity.

The question now appears—will there be any such incentive after the war is over? It is quite possible there will be, but whether it will be recognized or not depends largely on the attitude of those who are appointed to be responsible for the major research problems that have to do with the protection of this country and the prevention of future wars. This is a very grave responsibility and it should be remembered that in order to have any such plan function, it must be sold first to our scientists and engineers. It then becomes an educational program and one of no mean magnitude.

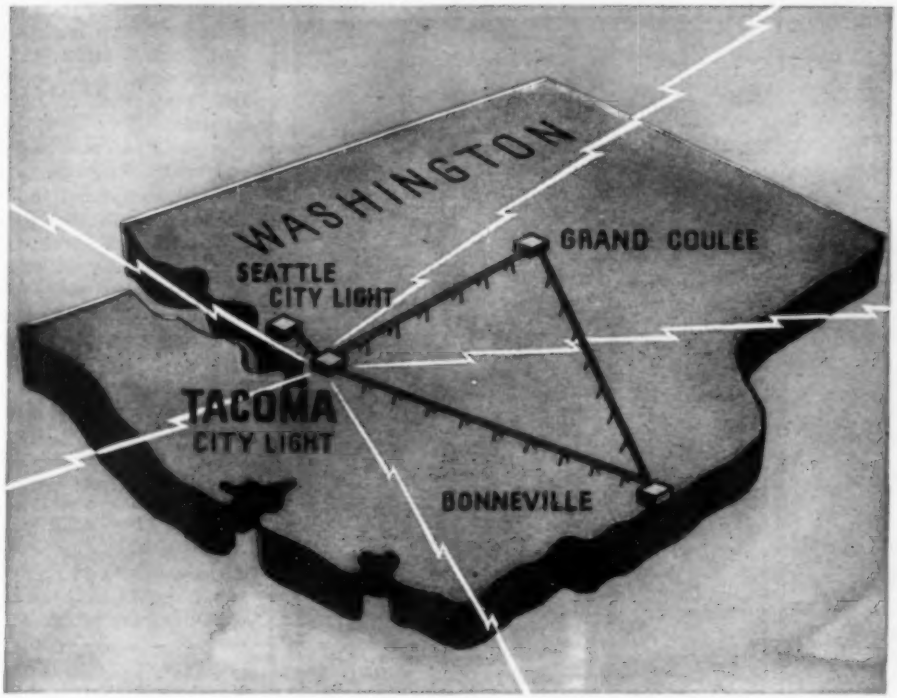
D. B. Keyes, before Miami Valley Chapter, American Institute of Chemists, Columbus, Ohio, May 11, 1945.

ORGANOSILICON CHEMISTRY

Though silicon is three times as abundant as aluminum and six times as abundant as iron, the only compounds of silicon which have heretofore been important are those natural forms of silica and the silicate minerals which are used in the building arts and in ceramic technology. Many synthetic or man-made compounds of silicon, some volatile, some soluble, some flexible and plastic, have long been known but have been confined to the laboratory as expensive curiosities. Only recently have chemists begun to explore the commercial possibilities of these synthetic organosilicon compounds.

At first, chemists were curious to see what would happen to the familiar organic compounds if some of the carbon atoms were replaced by silicon, carbon's neighbor in the periodic system of elements. More recently, however, the emphasis has shifted from the substitution of silicon in organic compounds to the substitution of organic groups in silicon oxides and halides. That is, instead of inserting a silicon atom in a predominantly organic structure (where it produces only a small but orderly change), organic groups are being inserted in predominantly inorganic silicon oxides (where they cause a great change in the properties of the substance).

These organosilicon oxides are known as silicones because they were first considered analogous to certain organic compounds called ketones. They are more properly thought of as organic-substituted sand or quartz, inheriting some of the characteristics of their inorganic and organic parentage. From these silicone structures



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• Basic raw materials are readily available in Tacoma and the many plants already here offer an excellent source of processed materials as well. Tacoma's water — pure and plentiful — is available at special low contract rates. Four transcontinental railroads meet tidewater here; excellent deepwater harbor facilities are linked to all rail lines by a municipal "Belt Line" which provides free switching service on line-haul traffic. Taxes and tax trends are favorable. The climate is ideal for year-round production. There are other advantages which may be important to your particular operation. Why not investigate? Write or wire: The Tacoma Chamber of Commerce, Tacoma 1, Washington.

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Tacoma

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Pacific Coast Center of Electro-Chemical, Electro-Metallurgical Development

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Users of this unusual service include: Nichols Engineering and Research Corp., Mutual Chemical Co., Maywood Chemical Co., and Consolidated Edison Co.

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there have been made a number of materials, such as resins, varnishes, and oils—all heat-resistant polymers in the same way that silica itself is polymeric and heat-resistant.

As is often the case, research in so new and unexploited a field has produced some entirely unexpected and surprising results. For example, at the Research Laboratory of the General Electric Co. it was found that the action of various organosilicon halides on glass, paper and cotton surfaces would render these surfaces water repellant to a high degree. Mere exposure of the surfaces to the vapor of methyl chlorosilanes suffices to impart a water-repellent film which withstands washing, drycleaning, and even considerable abrasion.

In the course of further research on organosilicon materials, it was found possible to make silicone oils which not only had the stability at high temperature which is characteristic of silicones, but also remained fluid at very low temperatures. In fact, the change of viscosity with temperature is so much less than that of ordinary petroleum oils that a single silicone oil often will suffice for operation of equipment from —50 to +400 deg. F. These silicone oils do not swell natural rubber nor corrode metals.

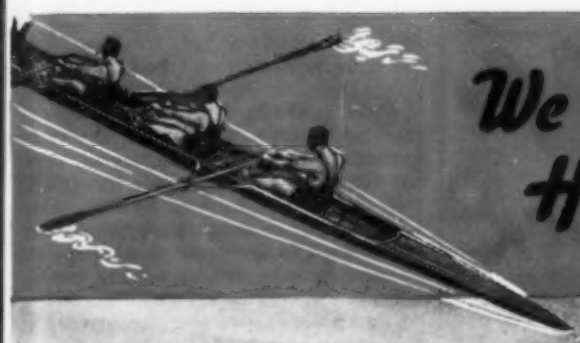
It seems probable that the organosilicon polymers will find use in the future not as direct competitors of the many present-day plastics, but rather in many applications where no present-day material will do, and where full use is made of the outstanding thermal durability of the siloxane network. From this viewpoint, the silicones are rightly placed as a new group of materials intermediate in properties and uses between the organic plastics on the one hand, and glass and the ceramic materials on the other.

E. G. Rochow, General Electric Co., before New York Section, American Chemical Society, New York, April 6, 1945.

DIELECTRIC HEATING APPLICATIONS

Dielectric heating heats materials internally and uniformly, not from the outside in as in the oven method but by passing alternating current at extremely high frequencies through materials such as wood, plastics, and even food and oils, which are poor conductors of electricity. Its scope extends to many applications in drying or curing processes in food, plastics, fine woods, ceramic materials, and in any cases where uneven or high outside temperatures cannot be used. Substances formed of large particles heat faster than those of smaller size. This might be applied in some industrial processes to heating catalyst beds, bringing such masses of particles up to their reaction temperature more quickly and uniformly than through usual mthods.

Because it heats uniformly, lower temperatures can be used in dielectric heating. Food oils have been dried at temperatures below the boiling point of water, thus avoiding damage to the oils. Dehydration of food while safeguarding nutritional values, and drying timber for fine lumber are other indicated applications, but the dielectric process can be used for anything



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A view of one of the gigantic production areas at the Clinton Engineer Works at Oak Ridge, Tenn.

If Germany had beaten our scientists to the completion of the atomic bomb, even in the final days of the war, world history would have been changed. In this fateful race, Alloy Steel Products was called upon to play a part as a supplier to *Manhattan District,* at Clinton Engineer Works.

That Aloyco came through on time is recognized in a letter from Lt. Col. A. C. Johnson of the Corps of Engineers, Manhattan District, who said: "I want to take this opportunity to extend to you our deep gratitude for the very excellent job Alloy Steel Products Company did and is doing for us. It was only through the wholehearted cooperation of industry that the job was done in the phenomenal short period of three years. You have every reason to be proud of the performance of your company in behalf of Manhattan."

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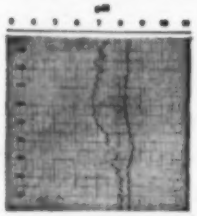

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which cannot stand high temperature at one point in order to get heat to another point. Dielectric heating also can be used as a tool in investigating the structure and chemical makeup of coal. In the usual methods of making coke from coal, there are differences of temperature throughout the process. But dielectric heating, maintaining the same temperature throughout, can be used to determine at what specific temperatures the various volatile constituents of the coal are released, thus adding to information concerning the makeup of coal.

Philip W. Schutz, Columbia University, before New York Section, American Chemical Society, New York, June 8, 1945.

PHOTOCHEMICAL FORCES AND REACTIONS

Most of the chemical reactions studied in the laboratory require heat as a catalyst, but the most important and familiar chemical reaction occurring in nature requires light as a catalyst. Reactions of the latter type are known as photochemical reactions, and the reaction referred to is photosynthesis. Photochemical reactions can be explained by chemical forces which depend for their strength on light absorption. These forces are defined as photochemical forces and, like ordinary forces between molecules, may be any one or a combination of three types.

The first type is electron-transfer forces. For example, thionine is a purple "dye" whose color is destroyed in the presence of iron ions and intense light. If the light is turned off the purple color reappears, which is clear evidence for forces which exist only in the presence of light.

The second type is electron-sharing forces. When solutions of fluorescein and iodide ions are mixed, no reaction takes place as proven by unchanged chemical and physical properties of these ions in the mixture. However, when light shines on this mixture, the intensity of fluorescence is less than that of fluorescein solutions with no iodide ion present.

The third type is photon-sharing forces. There is no counterpart of this type of forces among ordinary chemical bonds. These photon-sharing forces explain the strong fluorescence quenching action by molecules which have an absorption of the same frequency as the emission of the fluorescent molecules.

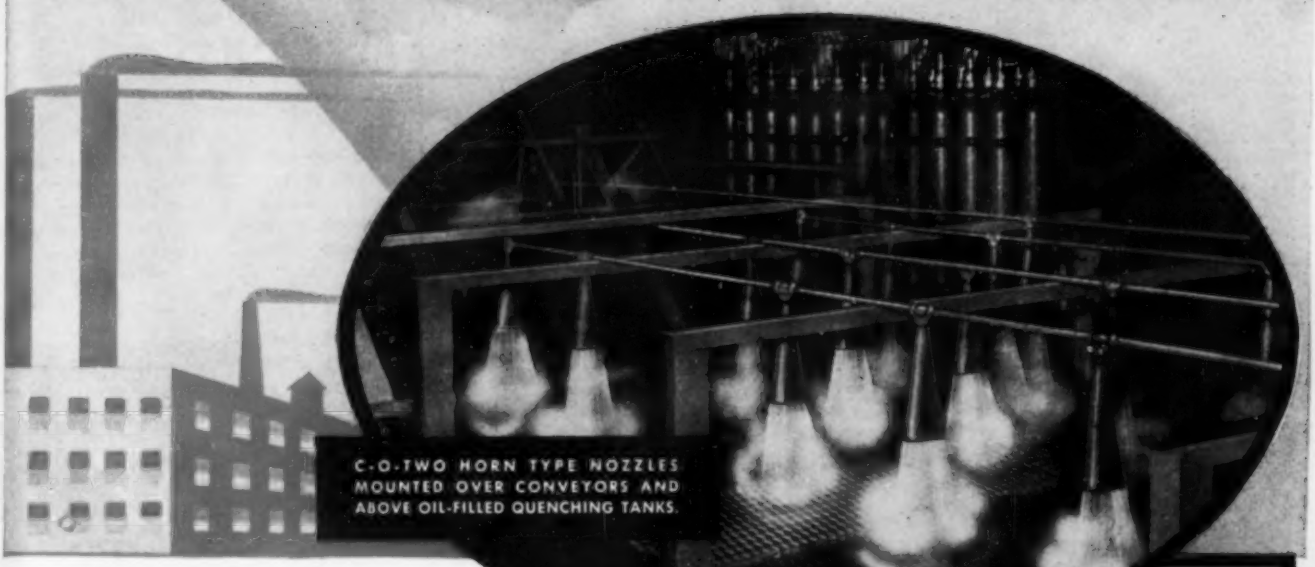
Jacob Q. Umberger, Columbia University, before New York Section, American Chemical Society, New York, June 8, 1945.

PARTICLE SIZES IN H. C. SMOKE SCREEN

Zinc and hexachlorethane are the chief ingredients of the H. C. Mix. Zinc chloride, (the smoke) is produced from the hot flame which accompanies the reaction. An oxidizing agent is used to burn up the residual carbon, so the smoke will be gray rather than black. In the manufacture of this product, a useful formula (percentage of ingredients) must be adopted and continued in use so as to reproduce the burning time as set in the specifications of the finished product.

Ingredients found in the laboratory to be identical chemically did not yield the proper burning time, no matter how care-

Hot shells take an oil bath!



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fully the formulas were adhered to. Upon examining the zinc dust with the "Fischer sub-sieve Sizer," it was found that the variations in the burning time of the mixes were explained in terms of the average particle size of the zinc used. In standard test samples, the variation in the zinc from 4 to 9 microns produced a variation in burning time from 65 to 95 sec.

This mixture has long been known to be water-sensitive. Therefore precautions were taken to dry the ingredients, weigh, mix, and load them in an air conditioned room. In spite of these precautions, the mix occasionally caught fire spontaneously. Following these fires over a period of months, it was found that approximately 90 percent of the fires occurred when zinc was used, the particle size of which was below 7 microns.

With the proper control of the zinc particle size, it was possible to reduce the hazard in the manufacture of, and improve the control of the burning time, of H. C. smoke screen products.

A. T. Burtsell, College of the City of New York, before New York Section, American Chemical Society, New York, June 8, 1945.

PERSONAL ASPECTS OF PROFESSIONAL DEVELOPMENT

THE TYPICAL chemical engineer is graduated from college at 22 to 23 years of age. This means an active professional life of 37 to 43 years. Let's assume, as an approximation, that we have 40 years to schedule. However, we need not be concerned with the last 20 years, since as a general rule the progress made in the first 20 years foreshadows subsequent progress. Accordingly, we may state as a broad principle, utilize to the utmost the 20 years from age 22 to 42.

The first 20 years in turn, may be divided into two 10-year periods, the period of establishment and the period of growth. Considering first the period of establishment, let's formulate the requirements for satisfactory progress:

A great deal has been said by employers, personnel experts, and educators concerning the selection of employees. However, from the point of view of the prospective employee, the selection of an employer is vastly more consequential. Although the cut-and-try method is extensively practiced, it is wasteful. Common sense dictates that not many false starts can be made without losing years of priceless time. At any rate, a careful weighting of job opportunities is certain to be time and effort well spent.

We climb on the academic assembly line at age 6 and tumble off at 22 or 23. Little wonder that the typical graduate becomes restive when in his first few years in industry he can't measure progress in terms of "A's," "B's" and "C's" and in terms of frequent, regular promotions. His only mathematical measure is his paycheck, which according to the psychologists always is 15 percent less than the recipient thinks is deserved. However, assuming he has confidence in his employer, his chief worry should be not about any apparent lack of progress, but whether he is turning out a 100 percent-plus performance on each assignment as it comes along. His worst enemy is impatience, and that

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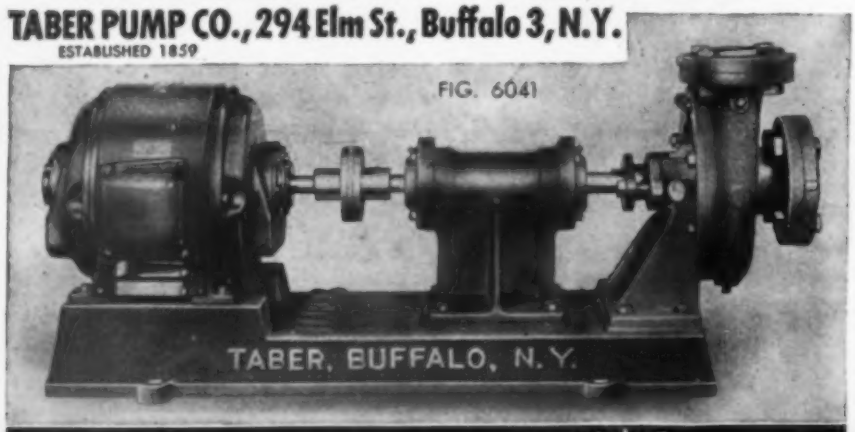

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enemy must be subjugated, otherwise there can be no sustained, effective effort.

Expeditious performance is a great prized quality. It can be summed up in three words—accuracy, thoroughness, and promptness. Spectacular performance is not expected, neither is it necessary. In the meanwhile, getting the job at hand done is everything that matters. Someone will be checking on the performance and with each check a plus, minus, or just so-so impression is registered.

Getting along harmoniously with people means being able to work with persons of all ranks and walks of life so that an atmosphere of mutual regard prevails. It means settling difficulties as much as possible on your own level, without burdening the boss; he has his own difficulties. It means, in the large organization, maintaining a delicate balance between team effort and individualism.

As tangible evidence of progress in the first 10 years you should find that your salary affords a substantial living standard, that you have earned the confidence of associates, subordinates, and supervisors, and that you have attained either a strategic position for line advancement, or a staff position, where, even though working as an individual, you are dealing with top management with all the advantage such contacts afford. From then on, the same factors continue to apply, although continued progress in the second 10-year stretch requires attention to these further factors.

Expression is the link between thought and action. It is the medium of salesmanship and administration. It is a reflection of personality. Master your language, by reading, writing, and speech.

Without an understanding of economic "law" no man can do a broad-gaged executive or engineering job. How to figure and interpret costs, prices, and profits is a big part of top responsibility. The engineer who is not interested in the economic side of his work virtually limits his future—unless he be a technical "genius" in every sense of the word.

For a while, the young chemical engineer can "get by" quite well with only a smattering of trade knowledge. However, subsequent growth requires breadth and depth of information covering competitors, consumers, suppliers, products, uses, costs, prices, earnings, tariffs, and so forth. It is largely empirical knowledge, but it is important. Knowledge of the trade also is a practical necessity in satisfactory dealings with the "higher-ups." It is part of their language.

The second 10 years is the period of growth. Your bosses have given you broadened opportunity in recognition of good work done in the first 10 years. The top bosses having literally as well as figuratively bet a substantial sum on your ability to make good, your objective is to demonstrate that their choice was not a mistake.

In this seasoning period of which we have allotted 10 years, you will gain a breadth and depth of experience not only in technical matters, but in working with the more intangible factors, such as labor relations, public relations, trade and customer relations. You also will develop into a real master of whatever function or

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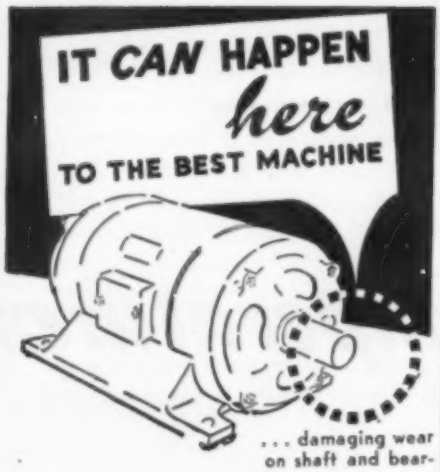

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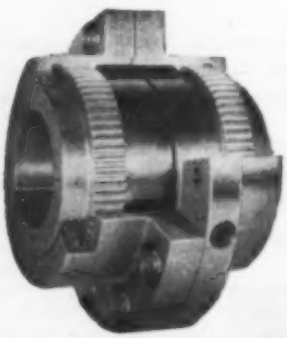

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technological branch you have chosen as a following.

These, then are the requirements for the personal side of your professional development. An outline such as has been suggested is of little value unless it can be put to use. One means of doing this is to make a personal audit each year, just as a business conducts periodic audits of various kinds, financial and otherwise.

Chaplin Tyler, Development Department, E. I. du Pont de Nemours & Co., before Junior Chemical Engineers of New York, April 25, 1945.

FOREIGN LITERATURE ABSTRACTS

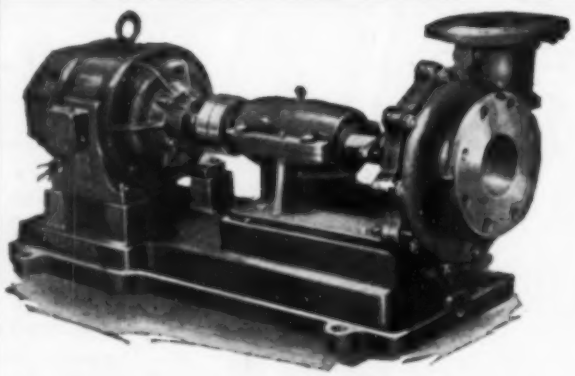
SULPHONIC ACIDS FROM GAS OIL

VERY little is known about the sulphonic acids obtained by sulphonation of the higher fractions of petroleum whereas sulphonation of the lower fractions, such as gasoline, has been used frequently to separate and identify the aromatic hydrocarbons. The sulphonic acids contained in these products consist of two principal groups: those soluble in petroleum fractions and those soluble in the acid tars. The classification can be broken down further by the different solubilities of the calcium salts in water and in ether as well as by the different colors of the ether solutions of the iron salts. The following acids were separated: α-sulphonic acids, the calcium salts of which are insoluble in ether and water, and the iron salts of which are also insoluble in ether; β-sulphonic acids, the calcium salts of which are insoluble in water but soluble in ether, and the iron salts of which dissolve in ether with an intense blue color; γ-sulphonic acids, the calcium salts of which are soluble in water but insoluble in ether, and the iron salts of which are insoluble in ether; δ-sulphonic acids, the calcium salts of which are insoluble in water but soluble in ether, and the iron salts of which are soluble in ether with a yellow color; sulphonic acid was also obtained from gas oil with an asphaltic base.

Digest from "Contribution to the Knowledge of Sulphonic Acids obtained from Gas Oil" by V. Th. Cerchez, *Oel u. Kohle*, **40**, 190, 1944. (Published in Germany.)

ULTRAVIOLET RAY ABSORPTION BY CELLULOSE DERIVATIVES

SPECTROPHOTOMETRIC experiments were conducted on the absorption of ultraviolet light by glass and certain derivatives of cellulose, specifically nitrocellulose and cellulose acetate, in the zone between 2,400 and 3,400 A, using films of a thickness corresponding to that of paints and varnishes. The absorption of all these substances was continuous except for a very weak zone of absorption in the cellulose acetate at 2,680 A. The least absorbent of these materials was cellophane, then pure cellulose acetate, pure nitrocellulose and, finally, glass which was the most absorbent. Introduction of plasticizers into the cellulose



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derivatives increased their power of absorption considerably. Exposure to ultraviolet radiation produced a considerable increase in the absorbent power of the pure or plasticized cellulose derivatives, a phenomenon which is accompanied by photochemical reactions of deterioration of the film. The degree of destruction was expressed by the coefficient of photochemical destruction of a substance submitted to the action of ultraviolet rays for 20 hr. The coefficient had a value of 3.4-4.5 for cellulose derivatives, depending on the plasticizer added, whereas cellophane had a coefficient of only 1.4.

Digest from "Variations in the Absorption of Ultraviolet Light by Cellulose Acetate, Nitrocellulose and Cellophane as compared with Glass" by J. Espinasse, *Peint. Pig. Vernis.* **19**, 34-42, 1943. (Published in France.)

NICKEL CYANIDE COMPOUNDS

New water-insoluble cyanide compounds were isolated by bringing together solutions of $K_2[Ni(CN)_4]$ with solutions of metallic salts or salts of organic bases. The general formula of these new compounds was $Me[Ni(CN)_4]$ in which Me represents Fe, Mn, UO_2, Co, Cu, etc. Some of these salts were also formed by warming precipitated nickel cyanide with solutions of metallic salts. In such cases half of the nickel contained in the nickel cyanide passed into the ionogenic state. These transformations indicated that nickel cyanide should be considered as the nickel salt of nickel-cyanhydric acid, i.e., as $Ni[Ni(CN)_4]$. This was confirmed experimentally by direct addition of organic bases to the nickel cyanide which resulted in formation of the amine compounds of $Ni[Ni(CN)_4]$. Further proof was provided by the fact that when the nickel cyanide was warmed with dimethylglyoxime, half of the salt was transformed into nickel dimethylglyoxime. It was found that the two isomeric compounds $Ni[Zn(CN)_4]$ and $Zn[Ni(CN)_4]$ could be produced by bringing together solutions of their respective ions. These two isomers were easy to distinguish by their color and their reaction to reagents for nickel. The compound $Zn[Ni(CN)_4]$ was the more stable form. Nickel cyanide behaved like nickel sulphide in respect to its non-precipitability in acid solution and the resistance of the precipitated product to acids.

Digest from "Investigations on Nickel-Cyanhydric acid and its Salts" by Fritz Feigl, Oswaldo Erichsen de Oliveira and Victor Demant, *Investigacoes Quimicas*, Departamento Nacional da Producao Mineral, Bulletin 11, 55-78, 1943. (Published in Brazil.)

DDT IN BRAZIL

Extension experimental work was done with DDT at the University of Sao Paulo. Its effect on flies, mosquitoes, fleas and cockroaches, and especially on the larvae of mosquitoes which carry malaria and yellow fever, was carefully studied and is shown in the attached table (p. 260). The tests were made both in the laboratory and in the natural habitat of the insect.

Digest from "Dichlorodiphenyl Trichloroethane (DDT)" by Richard Wasicky and Ovidio Unti, *Revista Brasileira de Quimica* XVIII, No. 108, 373-375, 1944. (Published in Brazil.)

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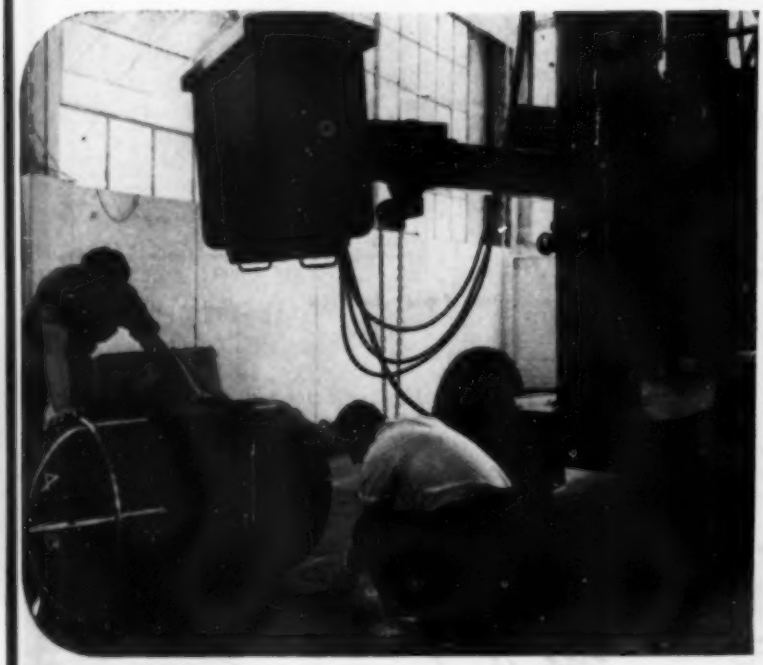

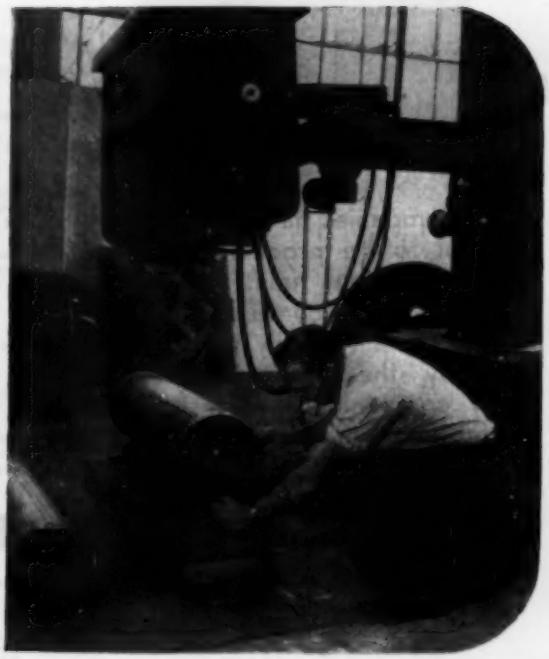

If you are looking for high quality and long, dependable service from tanks or cylinders, you will be wise to familiarize yourself with Scaife engineering design and manufacturing methods. Through careful attention to *all* details, we achieve the Scaife QUALITY CONTROL system that produces utmost uniformity and dependability.

It starts in the engineering department, where experience is combined with engineering and manufacturing knowledge to produce sound designs. It continues into the purchasing department where materials are bought according to strict specifications. It extends throughout all fabricating operations in the shop, where quality control methods guide every step of the manufacturing process. We use every practical means of assuring perfect forming, shaping and joining of component parts; and carefully executed tests at various stages of the manufacture of *every* tank or cylinder serve as a double check. And finally the finished container is thoroughly tested to be sure it completely meets all requirements of the code applying to its service. Actually, Scaife standards exceed the code requirements.

A system of this kind is not developed overnight. We have built these products for many years. We have installed equipment of the most up-to-date type, and perfected manufacturing techniques that assure strict adherence to the rigid Scaife standards.

The net result is that you can have complete confidence in the containers you buy from Scaife.

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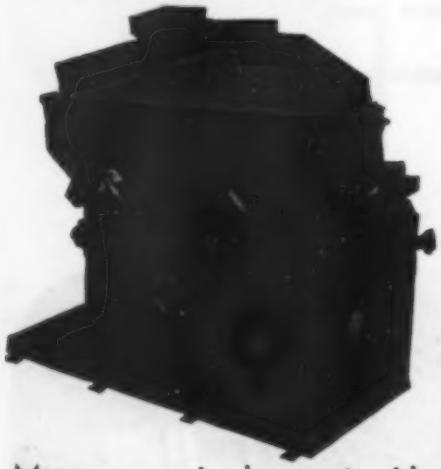

Many companies have set aside material to be processed at a more convenient time. Some of these materials contain mineral values that may easily be recovered by the proper process. Many companies have installed air tables to make

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THE PROCESS FOR BETTER PRODUCTS-FASTER

Effect of DDT on Insects as Determined at the University of Sao Paulo (See p. 258)

Species	DDT	Between 4 and 10 Min.	Between 10 and 30 Min.	2 to 6 Hr.	25 to 48 Hr.	48 to 72 Hr.	Observation
Musca domestica Muscina stabulans Stomoxys calcitrans	5% with talc. 0.5–1% in liquid	Flies fall from the walls with their wings in fibrilation. Others are already motionless and their feet retracted with cautious movements	Death of all the flies				
Culex quinquefasciatus Anopheles albitarsis Anopheles strodei	5% with talc. 0.5–1% in liquid	Same	Mosquitoes fall with wings in fibrillation and some with paralysed feet. Some dead	Death of all the mosquitoes			
Larva of Culex species	0.05 and 0.1% in 1000 water	Quick death					
Larva of Anopheles albitarsis	1 in 20,000,000 water			Death of all the larvae			
Larva of Anopheles strodei	1 in 50,000,000 water				Death of all the larvae		
Ctenocephalus felis	5% with talc.			Death			
Trichodectes canis	5% with talc.			Death			
Malofagos (Menoponidae)	5% with talc.		First toxic signs	Death			
Malofagos (Philopteridae)	5% with talc.		First toxic signs	Death			
Amblyomma cayennense (larva & nymph)	5% with talc.			First signs of toxicity	Death		
Amblyomma cayennense (adult)	5% with talc.				First signs of toxicity	Death	Animals under glass
Phthirius pubis	3% in liquid		Death of some	Death of all			Rubbing of infested parts
Triatoma infestans (larva)				Death			
Triatoma infestans (nymph)	3% in liquid						Death between 5th and 8th day
Blatta orientalis	5% with sugar			Few dead cockroaches	Some dead	All dead	Reaction by ingestion
Periplaneta americana	5% with sugar			Few dead cockroaches	Some dead	All dead	

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Metallic Bindings
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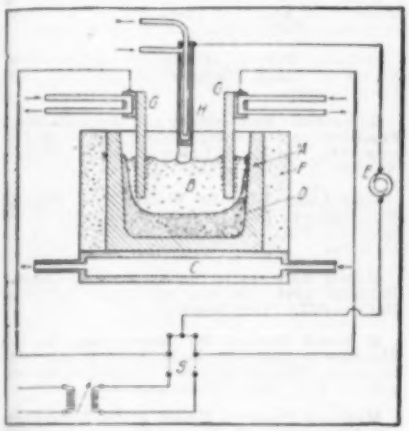
LESTER B. POPE, Assistant Editor



Left—Diagram of an early commercial cell for calcium production (from "Calcium Metallurgy and Technology"). *A* is graphite; *C*, Cooler; *F*, insulation; *B*, molten electrolyte; *D*, solid electrolyte; *G*, anode; and *H*, cathode

CALCIUM AND ITS ALLOYS

CALCIUM METALLURGY AND TECHNOLOGY. *By C. L. Mantell and Charles Hardy. Published by Reinhold Publishing Corp., New York. 145 pages. Price $3.50.*

PRODUCTION of calcium metal was never achieved on a serious commercial basis in the U. S. until our French and German sources (10 to 25 tons imported annually from 1920 to 1940) were cut off early in the war. Two processes, one based on electrolysis of fused $CaCl_2$, the other on thermal reduction of CaO, were then of necessity perfected to the point where they could meet our demands. The future of this capacity will depend upon the extent to which calcium can make itself useful in industry—or perhaps more properly, the extent to which chemists and metallurgists become aware of calcium's ability to serve their industries.

Toward this end the present work will serve as a valuable collection of information on the metal's properties. Alloy systems of calcium and other metals are discussed individually and constitute the major portion of the book. A few remaining chapters cover general properties, production methods and industrial applications. Though the authors have drawn to some extent upon their own experience in the industrial development of calcium, their most valuable contribution is in gathering and digesting scattered data and in promoting an appreciation for a material which deserves much more attention than it has heretofore received.

VERSATILE BEAN

THE USEFUL SOYBEAN. *By Mildred Lager. Published by McGraw-Hill Book Co., New York. 295 pages. Price $2.75.*

THE VALUE of this book lies in its bringing together all the stray bits of information on this crop that have been passing about more or less loosely during the past decade. The book tells the story of the soybean, its long history as one of the world's oldest foods. Agricultural and industrial potentialities of the soybean are a challenge to the food industrialist as well as the chemist. The book's emphasis, however, is on its nutritional value.

PIPING DESIGN

PIPING HANDBOOK. *Fourth edition. By Sabin Crocker. Published by McGraw-Hill Book Co., New York. 1,376 pages. Price $7.*

PURPOSE of this handbook continues to be to provide authoritative and accessible data for the engineer interested in piping design. This edition includes new chapters on gas piping, refrigeration piping, hydraulic power transmission piping and corrosion. Chemical and other engineers will find this reference helpful.

A LITTLE THEORY

CHEMISTRY FOR ELECTROPLATERS. *By C. B. F. Young. Published by Chemical Publishing Co., Brooklyn, N. Y. 205 pages. Price $4.*

MASTERS of the art of electroplating know from experience what ingredients go into their plating baths. But they may not always understand what happens therein. Dr. Young's book was written for electroplaters to give some theoretical background and insight into chemical phenomena. It is a brief elementary chemistry textbook with a few references to plating practice.

TASTE AND ODOR

FLAVOR. *By E. C. Crocker. Published by McGraw-Hill Book Co., New York. 172 pages. Price $2.50.*

IMPORTANCE of this book, as far as chemical engineers outside the food field are concerned, lies in its discussion of odor classification, physiology of flavor perception, volatility, essential oils, and testing. The author is associated with the Little laboratories in Cambridge and has had considerable experience as a consultant on the chemistry of flavor.

CEREOUS DATA

COMMERCIAL WAXES. *By H. Bennett. Published by Chemical Publishing Co., Brooklyn, N. Y. 583 pages. Price $11.*

FROM a multitude of sources the author has collected considerable information on paraffin and other natural and manufactured waxes. All sorts of miscellaneous data such as solubilities, hardness, compatabilities and crystallization points are offered on waxes, additives and various mixtures. A symposium by 21 authors on waxes in industry gives brief discussions of some of the commercial applications of waxes. A concluding section of 168 pages contains a formulary of polishes, cosmetics and other wax products.

ADDITIONAL DATA

USES AND APPLICATIONS OF CHEMICALS AND RELATED MATERIALS. *Vol. II. By T. C. Gregory. Published by Reinhold Publishing Corp., New York. 459 pages. Price $9.*

COMPLEMENTING and supplementing Vol. I, (see *Chem. & Met.*, November, 1939, p. 724) this book lists the uses of some 2,600 chemicals and related materials not treated in the first volume. As a new feature the book contains an index of uses which will help the reader to find suggestions relative to some particular application or use. Another new feature is an index of patents together with a list of addresses of owners.

ABIETIC—DYPNONE

DICTIONARY OF ORGANIC COMPOUNDS. *Vol. I. Revised edition. Edited by I. M. Heilbron and H. M. Bunbury. Published by Oxford University Press, New York. 1,072 pages. Price $30.*

A NEW revised edition of Heilbron's dictionary is planned and volume I, Abietic Acid—Dypnone, has been available for some months. According to the publishers it has been completely revised throughout. Now that the war is over, work will probably be resumed on revision of vols. II and III. Until new editions are available, supplements to the old edition may be obtained at $1 each.

SPECIAL STUDIES

PROTECTIVE AND DECORATIVE COATINGS. *Vol. IV. Edited by J. J. Mattiello. Published by John Wiley & Sons, New York. 419 pages. Price $5.*

THE FOURTH in this series is concerned with pigmented coatings, both during and after manufacture, and in the dried film. It is subtitled special studies: wetting, grinding, color, consistency, hiding, adhesion, permeability and film structure, livering of inks, microscopy, emulsions, vacuum technology and ultraviolet absorption of drying oils. All of these subjects are of importance in understanding and practical application in design and control of finished products. All the chapters have been prepared by experts. They give the technologist data, theory and practical applications from the technical point of view.

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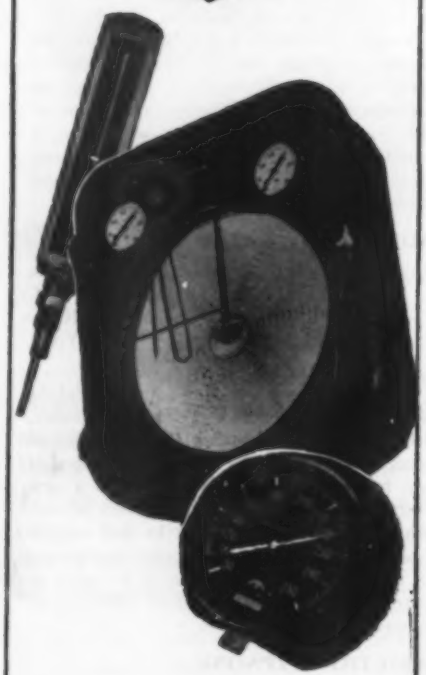

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GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering publications noted in this list always give the complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the bureau responsible for its issue.

United States Imports from China, An Analysis of the Prewar Trade. United States Tariff Commission. Mimeographed.

Post-war Imports and Domestic Production of Major Commodities. A Report of the U. S. Tariff Commission in Response to Senate Resolution No. 341. Senate Document No. 38. Price $1.75.

Ground-Water Resources of the El Paso Area, Texas. By A. N. Sayre and Penn Livingston. Geological Survey, Water-Supply Paper 919. Price 75 cents.

Magnetic Survey of the Florida Penninsula. By F. W. Lee, J. H. Swartz, and S. J. Hemberger. Bureau of Mines. Report of Investigations R.I. 3810. Mimeographed.

Low-Gravity Float-and-Sink Separations of Bituminous Coal Samples. By Thomas Fraser and others. Bureau of Mines. Report of Investigations R.I. 3812. Mimeographed.

Utilization of Three Kids Manganese Ore in the Production of Electrolytic Manganese. Bureau of Mines. Report of Investigations R.I. 3815. Mimeographed.

Effects of Boron in Steel. By R. B. Corbett and A. J. Williams. Bureau of Mines. Report of Investigations R.I. 3816. Mimeographed.

Gas Injection into the McCloaky Limestone in the Griffin and New Harmony Oil Fields, Indiana and Illinois. By C. H. Riggs. Bureau of Mines. Report of Investigations R.I. 3818. Mimeographed.

Hydrometer Correction Tables and Thermal-Density Coefficients for Vegetable Tanning Extracts. By Mary Grace Blair and Elmer L. Peffer. Bureau of Standards. Circular C449. Price 10 cents.

Union Agreements in the Petroleum-Refining Industry in Effect in 1944. Bureau of Labor Statistics. Bulletin No. 823. Price 10 cents.

Probable Volume of Postwar Construction. Bureau of Labor Statistics. Bulletin No. 825. Price 10 cents.

Guaranteed - Employment and Annual - Wage Provisions in Union Agreements, Effective January 1945. Bureau of Labor Statistics. Bulletin No. 828. Price 10 cents.

State Labor Laws for Women with Wartime Modifications. Part I. Analysis of Hour Laws. Women's Bureau. Bulletin No. 202-I. Price 15 cents.

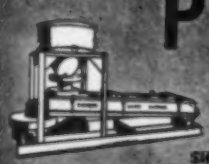
Hourly Earnings in the Ammunition-Loading Industry 1944. Bureau of Labor Statistics. Bulletin 827. Price 10 cents.

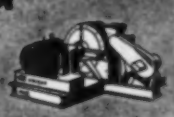
A Rapid Method for Determining Surface Moisture in Coal. By L. D. Schmidt and Wm. Seymour. Bureau of Mines. Report of Investigations R.I. 3811. Mimeographed.

Medicinal Products, United States Equivalents and Alternatives. By George R. Tompkins. Bureau of Foreign and Domestic Commerce. Industrial Series No. 11. Price 50 cents. Explains basis for selling alkaloids, biologicals, chemicals, glandular products, pharmaceutical specialties, vitamins in Latin America.

Mineral Statistics. The Bureau of Mines has begun issuing the separate preprint chapters of Minerals Yearbook 1944. These are being distributed in most cases without restriction for military reasons. Those wanting the latest

Materials PROCESSING EQUIPMENT





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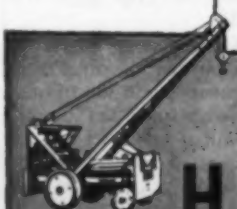

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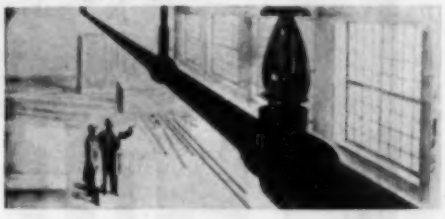

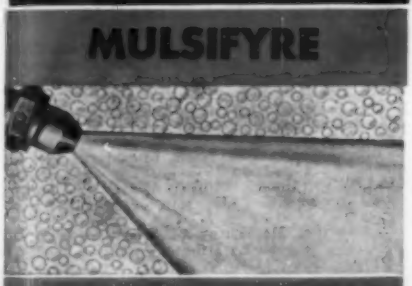

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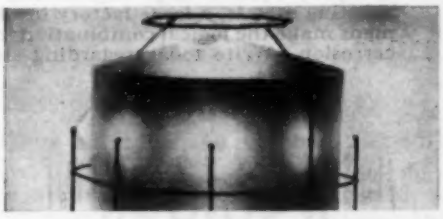

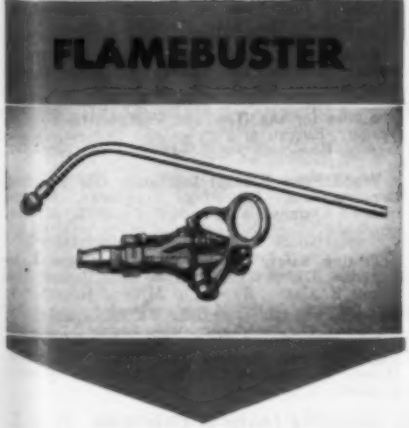

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printed data should ask the bureau for it indicating the specific commodities in which they are interested. No general mailing lists are maintained.

Forest Products Publications. During recent months the following mimeographed documents have been released by Forest Products Laboratory, Madison, Wis., from which single copies are available on request: FPL Report R1481 Acid Hydrolysis of Waste Wood for Use in Plastics. R1475 Saccharification of Wood. R1486 Development of Shear Strength in Maple Block Joints Made with Two Resorcinol Glues at Temperatures from 40° to 80° F. 1534 Effect of Moisture Content of Wood on Joint Strength in Gluing Birch Veneer and Maple Lumber with Room-Temperature-Setting and Intermediate-Temperature-Setting Phenol, Resorcinol, and Melamine Glues. 1533 Experiments to Develop a Rapid Durability Test for Urea-Resin Glues. 1532 Stability of Low-Temperature-Setting Phenol, Resorcinol, and Melamine Resin Adhesives Stored at 80° F. 1336 Synthetic-Resin Glues. 1521 Some Strength Properties at Elevated and Subnormal Temperatures. 1521-A Effect of Accelerated Weathering on Certain Strength Properties of Papreg. 1521-B Effect of Moisture on Certain Strength Properties of Papreg. 1521-C Effect of Repeated Cycles of Freezing and Thawing on Certain Strength Properties of Papreg. R1483 Low-Resin-Content and Resin-Free Pulp Plastics. R1480 Mill-Trial Comparison of Asphalt-Sized, Wet-Strengthened and Nonwet-Strengthened Cylinder Chipboards. R1461 Pulp-Reinforced Plastics. R1472 Pulps for Pulp-Reinforced Plastics. R1477 Semichemical Pulp. R842 Briquetting of Wood Waste. R565 Wood Flour.

Equilibrium in the Reduction of Ferrous Chromite by Hydrogen and Energy Requirements in the Selective Reduction of Iron in Chromite. By F. S. Boericke and W. M. Bangert. Bureau of Mines. Report of Investigations R.I. 3813. Mimeographed.

Bibliography of Russian Literature on Geophysical Exploration 1929-41. By W. Avvanogfou and V. Skitsky. Bureau of Mines. Information Circular I.C. 7323. Mimeographed.

Extractive Metallurgy of Beryllium. By W. J. Kroll. Bureau of Mines. Information Circular I.C. 7326. Mimeographed.

State Labor Laws for Women with Wartime Modifications, December 15, 1944. Part 3, Analysis of Regulatory Laws, Prohibitory Laws, Maternity Laws. Labor Department, Women's Bureau. Bulletin 202-3. Price 5 cents.

Dismissal Pay Provisions in Union Agreements, December 1944. Bureau of Labor Statistics. Bulletin No. 808. Price 5 cents.

Trends in Urban Wage Rates, April–October 1944. Bureau of Labor Statistics. Bulletin No. 809. Price 5 cents.

Paid Vacations in American Industry 1943 and 1944. Bureau of Labor Statistics. Bulletin No. 811. Price 10 cents.

Average Hourly Earnings in the Explosives Industry, June 1944. Bureau of Labor Statistics. Bulletin No. 819. Price 10 cents.

Extent of Collective Bargaining and Union Status, January 1945. Bureau of Labor Statistics. Bulletin No. 829. Price 5 cents.

Guides for the New and Prospective Foreign Trader. Bureau of Foreign and Domestic Commerce. Economic Series 44. Price 15 cents.

Wood Fiber Blanket Insulation (for Building Construction). Bureau of Standards. Recommended Commercial Standard TS-3955. Mimeographed.

Testing Safety Catches on Mine Cages Lake Superior District. By Clyde M. Pearce and Frank E. Cash. Bureau of Mines. Information Circular I.C. 7325. Mimeographed.

Inspection Standards for Bituminous-Coal and Lignite Mines, Revised July 1945. Bureau of Mines. Information Circular I.C. 7333. Mimeographed.

Controlling Insects in Flour Mills. By R. T. Cotton, J. C. Frankenfeld, and G. A. Dean. Department of Agriculture. Circular No. 720. Price 15 cents.

Testing Fabrics for Resistance to Mildew and Rot. By Paul B. Marsh and others. Department of Agriculture. Technical Bulletin 892. Price 10 cents.

Federal Specifications. New or revised specifications which make up Federal Standard Stock Catalog have been issued on the following items: Paint; Resin-Base Emulsion, Interior, Paste, White and Tints TT-P-88a. Paint; Stencil, Flat TT-P-98. Plaster; Gypsum SS-P-402. Mineral-

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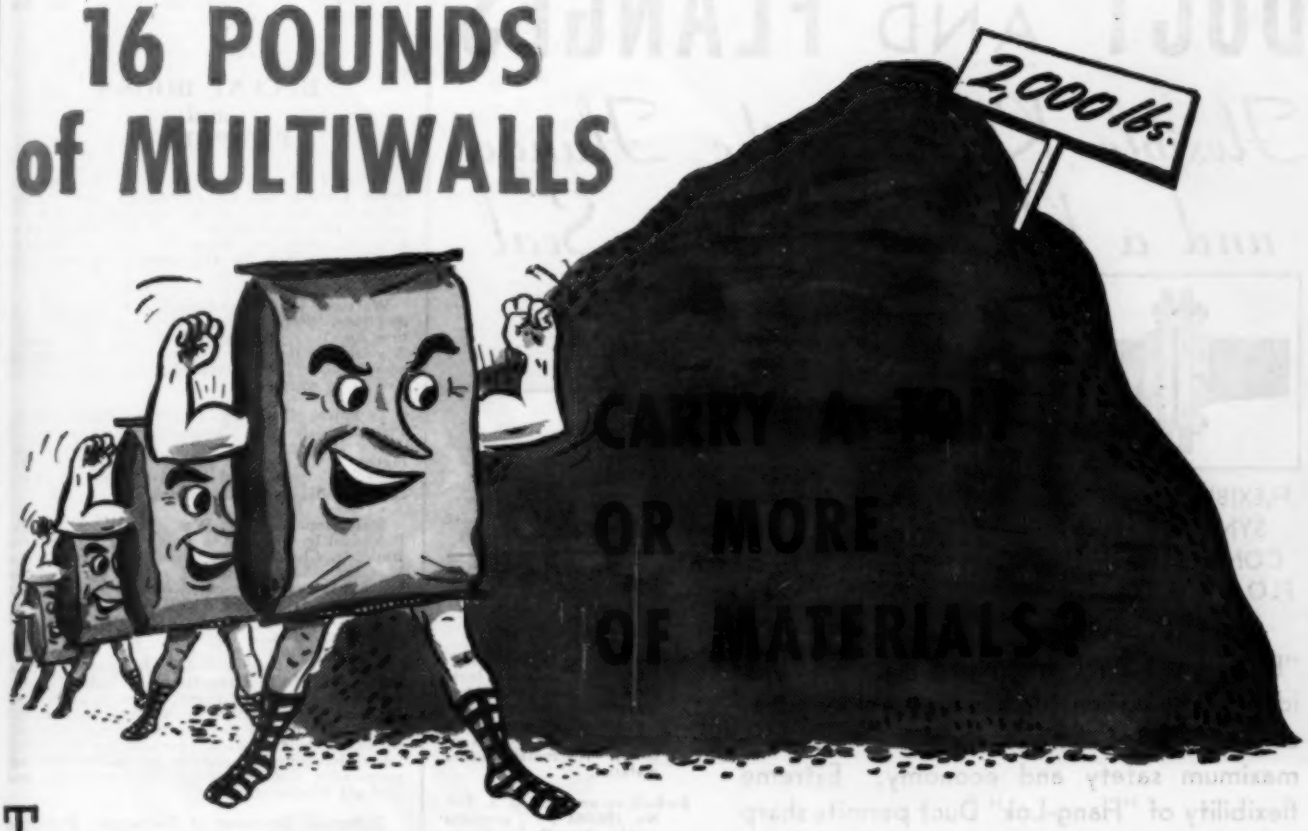

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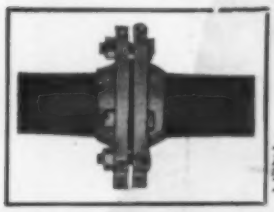
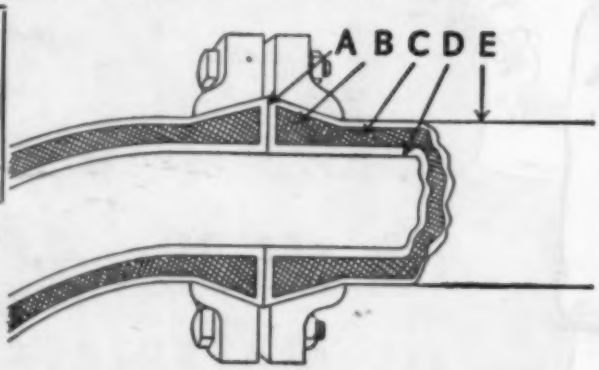
GOODALL "FLANG-LOK" DUCT AND FLANGES

Flexible Right to the Flange, and a Rubber-to-Rubber Seal





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B—Built-up end . . . U. S. Pat. No. 1883086 . . . provides ample strength for flange collars.

C—Patented non-flattening carcass construction will not collapse, kink or retard flow on sharp bends.

D—Thick tube resists abrasive wear, prevents permeation of liquids or gases into wall structure.

E—Tough, long-wearing cover stock . . . unaffected by acids or fumes.

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U. S. Army Specification No. 6-345 gives specifications for cotton duck to make it fire, water, weather, and mildew-resistant, including requirements as to chemicals required for this processing.

RECENT BOOKS and PAMPHLETS

National Design Specifications for Stress-Grade Lumber and Its Fastenings, 1944. Published by National Lumber Manufacturers Association, 1319 Eighteenth St., N.W., Washington 6, D. C. 64 pages. Price 25 cents. A comprehensive standard for engineering designs with lumber.

Wartime Recommendations for Refinery Inspections. Prepared by Petroleum Administration for War, Washington, D. C. 170 pages. A guide for the inspection of existing operating equipment. The recommendations apply now as well as in wartime.

Technical Data on Plastics. Published by Plastic Materials Manufacturers' Association, Tower Building, 14th and K Sts., N.W., Washington 5, D. C. 163 pages. Price $1.50. Revised edition. Gives technical data on all of the commercially available plastics.

Steel Expansion for War. By W. A. Hauck. Published by the Penton Publishing Co., Penton Building, Cleveland 13, Ohio. 192 pages. Price $2. An official, historical report prepared for WPB. Data are presented on facilities installed or revamped by some 3,000 companies together with details on type of products, costs and added capacities.

Ammonia. Published by Division of Labor Standards, U. S. Department of Labor, Washington 25, D. C. 12 pages. First of a series of bulletins to be issued on controlling chemical hazards. Describes the hazards of the chemical, its characteristics, safety precautions for installation, handling and storage, protective clothing, permissible and hazardous concentrations, and first aid treatment.

Industrial Resources of Tennessee. Published by Tennessee State Planning Commission, Industrial Development Division, 432 Sixth Ave., North, Nashville 3. 210 pages. Price $1. Natural resources, electric power, water supply, labor, transportation facilities, industrial regulations, taxes, and licenses. Illustrated. Maps, charts and tables.

Plastic Working of Metals and Non-Metallic Materials in Presses. Third edition. By E. V. Crane. Published by John Wiley & Sons, New York. 540 pages. Price $5. Shearing, bending, drawing and other operations. Primarily concerned with metals.

Chemical Engineering. By C. E. Reed. Published by Bellman Publishing Co., 6 Park St., Boston, Mass. 20 pages. Price 75 cents. A vocational guidance monograph.

Handbook of Pest Control. By Arnold Mallis. Published by MacNair-Dorland Co., 254 West 31st St., New York 1, N. Y. 554 pages. Price $6. Rats, mice, roaches, termites, flies and other household pests.

Coal Tar Fuels. Edited by J. S. Sach. Published by the Association of Tar Distillers, 166 Picadilly, London, W.1. 143 pages. Price 15s. British practice in the utilization of fuels ranging from fluid creosote to pulverized hard pitch.

Engineering Preview. By L. E. Grinter, H. N. Holmes, H. C. Spencer, R. Oldenburger, C. Harris, R. G. Kloeffler, and V. N. Faires. Published by the MacMillan Co., New York. 581 pages. Price $4.50. An introduction to engineering for high school seniors and college freshmen.

The Art of Resuscitation. By P. J. Flagg, M.D. Published by the Reinhold Publishing Corp., New York. 453 pages. Price $5. Preventable and unnecessary deaths from asphyxia are a daily occurrence. Physicians and first aid workers will find this book a scholarly study of the subject.

Physical Foundations of Radiology. By O. Glasser, E. H. Quimby, L. S. Taylor and J. L. Weatherwax. Published by Paul B. Hoeber, Inc., New York. 426 pages. Price $5. History, production, theory and use of X-rays. Written primarily for physicians.

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterheads.

Agitators. Eclipse Air Brush Co., Inc., 390 Park Ave., Newark 7, N. J.—24-page booklet illustrating the wide variety of applications for Pneumix air motor agitators manufactured by this company. Various types of agitators are illustrated, together with the current price list.

Alloys. The Duraloy Co., Scottdale, Pa.—Bulletin 4328-G. 12-page booklet describing the special alloys used for resisting corrosion, high temperatures, and abrasion. Various types of Duraloy and their uses are described. Included is a table giving the main properties of various alloys under different conditions.

Autoclaves. Union Iron Works, Erie, Pa.—4-page illustrated booklet describing the Coil-o-clave system for heating or cooling autoclaves or process kettles. Details of construction together with the advantages of this equipment are given.

Blowers. Buffalo Turbine Corp., 2165 Bailey Ave., Buffalo 11, N. Y.—Bulletin No. 745. 4-page folder featuring the high pressure axial fans and blowers made by this company. Information on the design, application, installation and capacities, together with a graph of pressure flow characteristics, is included.

Boilers. Titusville Iron Works Co., Titusville, Pa.—Bulletin describing the portable firebox boiler for high pressure steam generation. This boiler is particularly suitable for stoker firing, and may be used with any type of fuel. Bulletin contains informative diagrams and technical information.

Carbon Black. Witco Chemical Co., 6200 West 51st St., Chicago, Ill.—Three technical bulletins No. 44-3, 45-1, and a reprint entitled "Compounding GR-S with Channel Black and Mineral Rubber," which give data on compounding rubber with furnace and channel black.

Coatings. Tennessee Eastman Corp., Kingsport, Tenn.—2-page bulletin describing the coating and impregnating of paper and fabrics with Tenite II, cellulose acetate butyrate plastic.

Control Systems. Reynolds Electric Co., 2650 W. Congress St., Chicago, Ill.—Bulletin No. 71. 4-page leaflet describing Reco motor-driven controls for predetermined timing, time delay, synchronizing, automatic starting and stopping, reversing action, sequence operation, automatic and repeat cycles, signaling and keying.

Conveyors. Lamson Corp., Syracuse 1, N. Y.—12-page booklet describing in detail the use of barrel conveyors in the petroleum industry. A number of plant layouts showing the conveyor systems are included. 4-page leaflet describing the lightweight portable gravity conveyors for both inside and outside use.

Conveyors. Robinson Air Activated Conveyor System, 205 East 42nd St., New York 17, N. Y.—4-page illustrated pamphlet describing air-activated conveyors. Schematic arrangement of a typical installation, together with a list of typical materials which can be handled by this system is included.

Corrosion Resistant Materials. U. S. Stoneware Co., Akron, Ohio—Bulletin H. 16-page illustrated booklet describing briefly the corrosion resistant materials now available from this company.

Dryers. J. O. Ross Engineering Corp., 350 Madison Ave., New York 17, N. Y.—Catalog No. 131. 24-page illustrated booklet describing the various industrial dryers built by this company and the major types of applications in various industries. Included is a section on the principles and processes in industrial drying, sources of heat, materials handling, temperature control, and other useful information.

Electric Equipment. Walker-Jimieson, Inc., 311 South Western Ave., Chicago 12, Ill.—A

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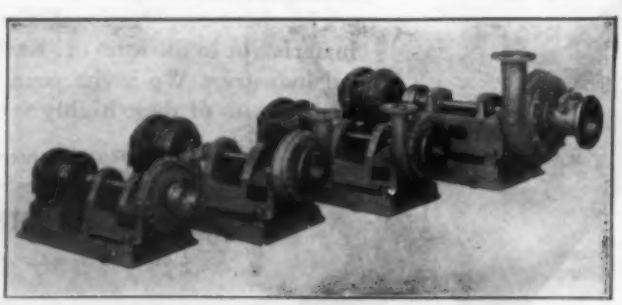

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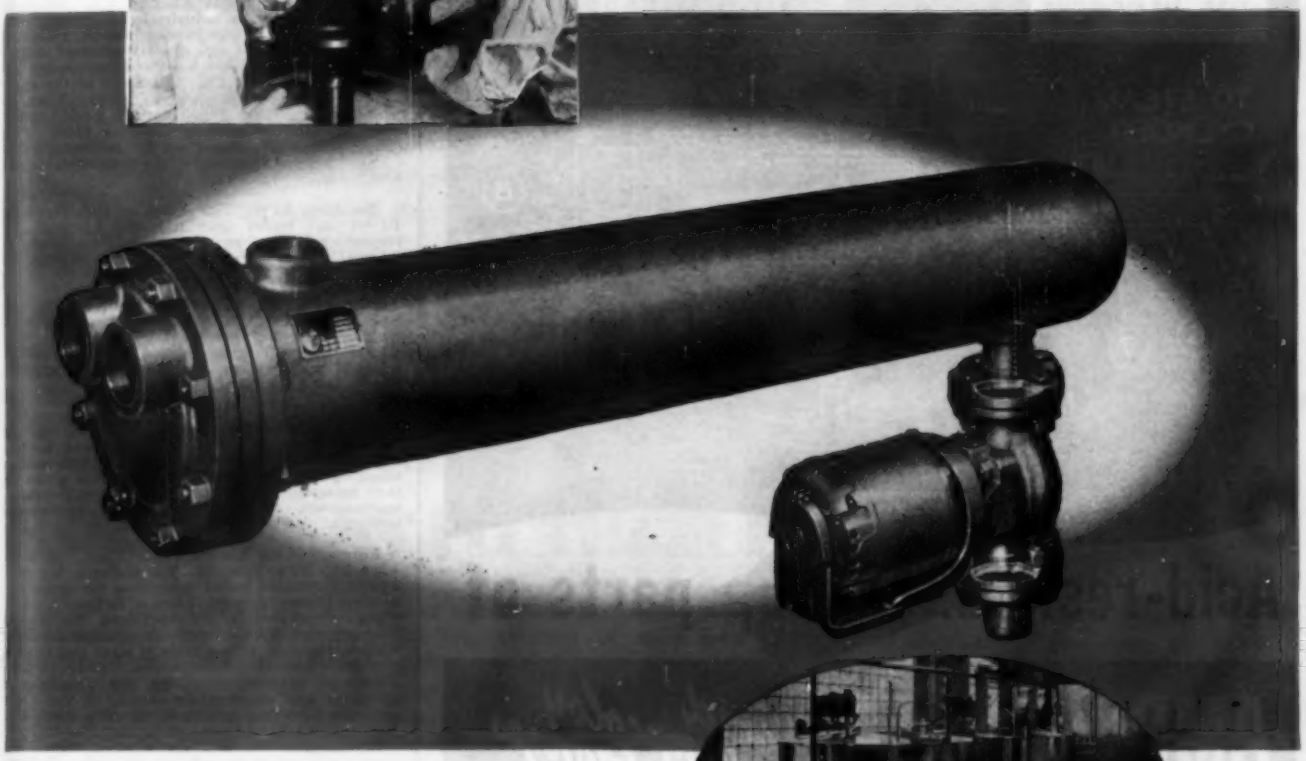


"WU" HEATER + BOOSTER = CASH SAVINGS!

Here's the buy of the year in water heaters! Here's the Heater which not only gives positive control of service water temperature but costs less to install and operate!

The "WU" Instantaneous Water Heater (water to water heat transfer) is equipped with a B & G Booster which pumps boiler water through the shell, thereby greatly increasing the capacity of the Heater. Large volumes of hot water are produced by an amazingly small unit.

Slashes material and labor cost!

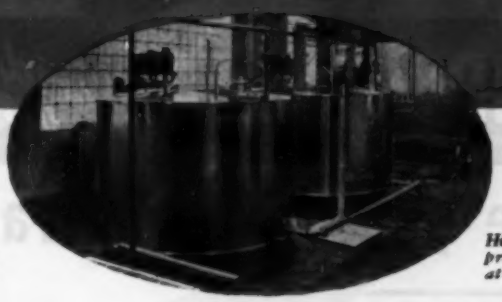
Because of pumped circulation, the connecting pipes and fittings are radically reduced in size. Hence, material cost is trimmed to the bone and cutting and threading can be done on the job. No storage tank needed—another substantial saving.

Controls service water temperature!

The Booster also provides a means of closely controlling service water temperature. A hot water control, installed in the hot service water supply line, starts the Booster whenever service water temperature goes below the desired degree. The Booster pumps boiler water through the shell of the Heater *until service water is again at the correct temperature,* and is then stopped by the control.

All for less money!

The combined cost of the "WU" Heater, Booster, pipe, fittings and labor is actually less than for a gravity-circulated heater installation big enough to do the same job. Write for price and capacity data.



Hot water for process uses at low cost.

B & G TYPE "SU" INSTANTANEOUS WATER HEATER

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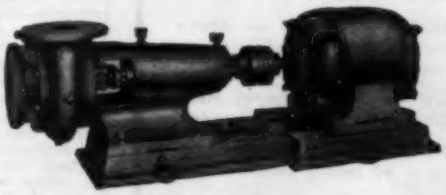

B & G CENTRIFUGAL PUMPS

A complete line of pumps with semi-open or enclosed impellers. Furnished flexible—coupled or with motor and pump combined as an integral unit.

B&G WATER HEATERS

BELL & GOSSETT CO.
MORTON GROVE, ILL.
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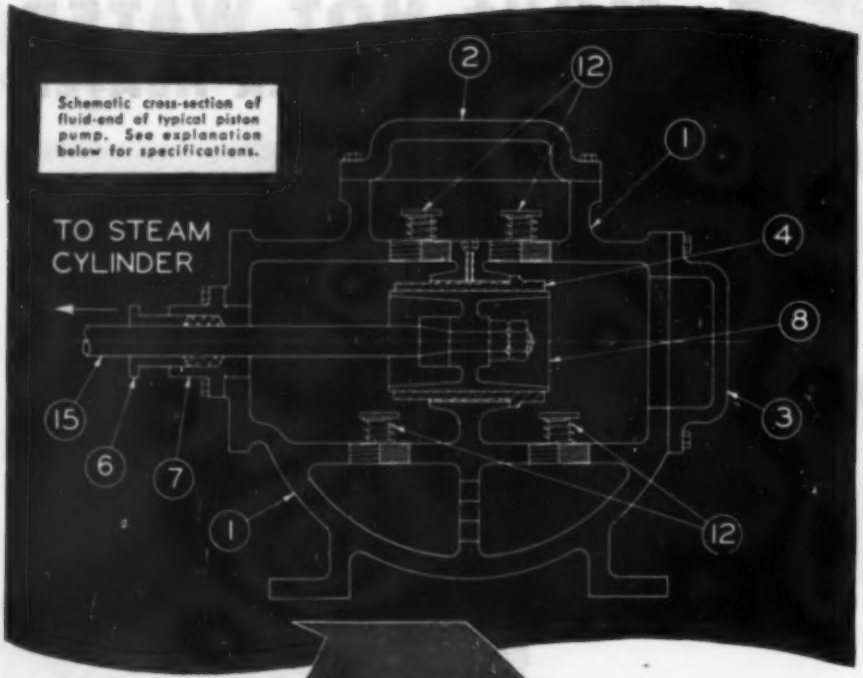

Acid-resistant pump parts of AMPCO METAL and ampcoloy bronzes give you these advantages:

9 places where use of Ampco alloys helps assure longer pump life:

1. *Pump housing* — Ampcoloy A-3 usually recommended.
2. *Valve cover* — Ampcoloy A-3 usually recommended.
3. *End cover* — Ampcoloy A-3 usually recommended.
4. *Cylinder liner* — Ampco Metal Grade 18 usually recommended.
6. *Stuffing box gland* — Ampco Metal Grade 18 usually recommended.
7. *Stuffing box* — Ampco Metal Grade 18 usually recommended.
8. *Piston* — Ampcoloy A-3 or Ampcoloy 40 usually recommended.
12. *Valves* — Recommendation depends upon design.
15. *Piston rod*—Ampco Metal Grade 15 or Ampcoloy 45 Extruded Rod usually recommended.

The above recommendations are basic, but very general. Specific recommendations depend on design details, composition of corrosives, electrolysis, and operating conditions.

1. **Exceptional resistance to corrosion, erosion, abrasion, and cavitation in the routing of liquids, semi-fluids, and liquids containing solids in suspension — such as acids, petroleum sludge, alkaline solutions, sea water, mine waters, food-product liquors, hot brine, etc.**
2. **Desirable service characteristics — favorable bearing properties . . . high strength . . . ability to resist squashing, bell-mouthing, wear, impact, fatigue.**

Distinguished by their exact chemical composition and extremely low impurity content, Ampco alloys are proving their qualifications for successfully meeting varied conditions of corrosion, velocity, temperature, pressure, and consistency, in an increasing number of process industries.

Ampco Metal is a complete aluminum bronze series, varying from soft to hard, with physical properties closely controlled to fit specific service conditions. Available as sand or centrifugal castings, machined parts, and fabricated units.

Ampcoloy bronzes are a series of low-cost, high-quality copper-base alloys varying in hardness, tensile and yield strength, and elongation.

Ampco's nation-wide organization of field engineers — backed up by the competent metallurgical and engineering staff at Milwaukee — stands ready to share with you its 30 years' experience in solving corrosion problems on all sizes and types of pumps. Call on us.

Write for bulletins giving further details — to help you do a more creditable job of solving corrosion-resistance problems at lower ultimate cost, with equipment made of durable Ampco Metal. *Ampco Metal, Inc., Dept. CM-9, Milwaukee 4, Wis.*

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AMPCO Metal

The Metal without an Equal

series of brochures designed to acquaint industry with various types of equipment available for improving production, inspection and research facilities. These brochures cover voltage supply equipment, lighting equipment, sound equipment, etc.

Electronics. General Electric Co., Schenectady, N. Y.—A new industrial electronics, talking slidefilm training course, which offers a thoroughly practical and quickly grasped understanding of the subject has been announced by the General Electric Co. The price of the complete course (12 slidefilms and records, 25 sets of 12 review booklets, 1 instructor's guide, and a compact, durable carrying case) is $100. This course is carefully organized for presentation in 12 sessions and is given in a nontechnical manner.

Electronic Gage. The Autotron Co., Danville, Ill.—4-page leaflet describing the Autotron for inspecting internal or external surfaces, such as internal depths, external lengths, or outside diameters.

Filters. R. P. Adams Co., Inc., 55 Chicago St., Buffalo, N. Y.—Bulletin 678. 4-page leaflet describing the type TF-1 water filter for use in filtering both domestic and industrial water supply. Specification, installation and application data are included.

Filters. Filter Media Corp., Irvington-on-Hudson, N. Y.—52-page booklet illustrating and describing in detail the filter plates and frames, filter media, and filter element covers manufactured by this company. Information is given on the materials of construction, specifications, maintenance, and application. Also contains a section of useful engineering data.

Filters. Oliver United Filters, Inc., 33 West 42nd St., New York, N. Y.—Bulletin No. 209, 2-page illustrated leaflet describing the principles of the Oliver precoat filter. Bulletin 111-R. 4-page illustrated leaflet describing the Sweetland pressure filter. Details of construction, operation, together with a table of sizes and capacities are included. Bulletin No. 112-R. 4-page illustrated booklet describing the principle of operation and construction details, of the Kelly pressure filter manufactured by this company. Bulletin 405-R. 12-page illustrated booklet describing filtration and clarification equipment used in the petroleum refining industry. Bulletin No. 214. 8-page booklet giving the distinctive features and general application of the complete line of filter equipment made by this company.

Flooring. Continental Asbestos & Refining Corp., 1 Madison Ave., New York 10, N. Y.—Bulletin describing Stonoleum, a self-bonding, "self-healing" flooring material which has many of the favorable characteristics of concrete, but does not dust, crack, pit or crumble. It is valuable in repairing old flooring.

Instruments. Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10, Ohio—Bulletin 83-C. 8-page illustrated booklet on feed water regulators which describes and illustrates improved designs of thermo-hydraulic generators and bellows operated feed water regulator valves. Various features together with the principle of operation are included. Bulletin 62. 12-page illustrated booklet describing this company's open channel meter for sewage industrial wastes, sludge and irrigation water or any liquids with solids in suspension. Data on the principal features, application, operation and installation.

Instruments. Barton Instrument Co., 2306 East 38th St., Los Angeles 11, Calif.—Bulletin 11C2. 8-page bulletin describing the Model 161 indicator for flow, liquid level, and pressure differential. Features of this instrument together with details and application data are given. Bulletin 30-1. 4-page leaflet describes the principles of flow measurement and includes a drawing of typical installation.

Instruments. Fischer & Porter Co., Hatboro, Pa.—Catalog 43-E. 12-page illustrated catalog dealing with armored rotameters for measuring and controlling flow rates at high pressures and temperatures. Tables of dimensions, specifications and rotameter capacities are included. Included also is a rotameter nomograph for steam to determine the proper size of instrument for steam measurement. Catalog Section 98-Y. 24-page booklet describing in detail the theory of rotameters and covers the history and technical development of this type of meter. Rotameter capacities and correction factors for liquid gases and vapors together with other technical and engineering data are included.

Instruments. Process & Instruments, 60 Greenpoint Ave., Brooklyn 22, N. Y.—2-page leaflet describing the facilities and service offered by this company. This service includes analysis of process problems, development of special methods and instruments, manufacture of instruments and equipment testing.

Labor Relations. Elliott Service Co., 219

THIS CRYSTAL BALL TELLS US HOW TO MAKE ROLLS THAT FIT THEIR FUTURE

From long and varied roll-making experience Farrel-Birmingham engineers know in advance the requirements of rolls used in eighteen vital industries. Knowing these requirements, and using the facilities of *the largest specialty roll shop in America,* we are able to produce rolls that fit individual needs exactly.

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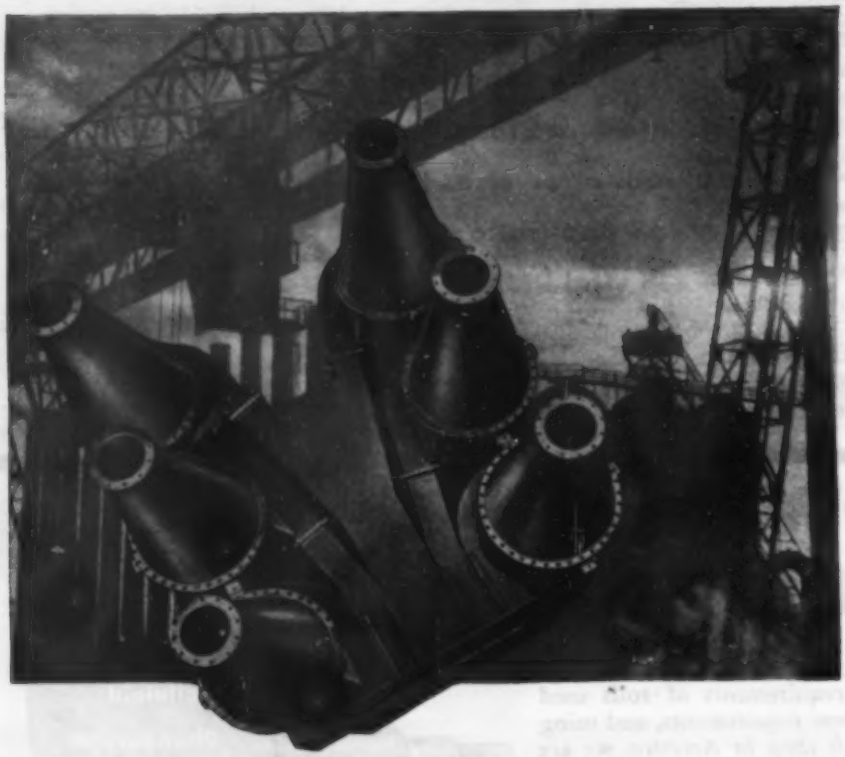
SPLIT-DUCT MANIFOLDING



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HIGH EFFICIENCY, LOW MAINTENANCE, LONG LIFE

SPLIT-DUCT MANIFOLDING used in Buell (van Tongeren) Multiple Cyclones ensures *uniform* distribution of *both gas* and *dust* to the cyclone collectors. This method is most important to final collection efficiency. Uneven distribution can cause local recirculation of gas, resulting in greater erosion rates in the cyclones receiving the higher concentrations and in the impairment of collection efficiency. With Split-Duct Manifolding, a Buell design feature, maximum collection efficiency is attained by this uniform distribution of the gas load.

The outlet can be installed to discharge the cleaned gases from *any side* or *end*, a flexibility of arrangement that cannot be obtained with *unit chamber manifolding*.

Buell Dust Recovery Systems are designed to do a job, not just to meet a "spec". A promise fulfilled by Buell's high efficiency, long life and low maintenance in hundreds of installations throughout American industry.

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East 44th St., New York 17, N. Y.—8-page illustrated catalog describing seven guidance manuals for the purpose of helping foremen, supervisors and department heads meet labor relations problems during reconversion and competitive postwar production.

Optical Crystals. The Harshaw Chemical Co., 1945 East 97th St., Cleveland 6, Ohio—8-page reprint illustrating and describing the development, manufacture and uses of synthetic optical crystals made from sodium chloride, potassium bromide and lithium fluoride.

Oxygen. Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.—24-page illustrated booklet describing the manufacture and industrial uses of oxygen.

Pipe Couplings. Drinkwater, Inc., 2323 South Michigan Ave., Chicago 16, Ill.—4-page leaflet describing the Presto-Lock flexible pipe couplings manufactured by this company. Installation details together with specifications are given.

Pipe Fittings. Bonney Forge & Tool Works, Allentown, Pa.—32-page handbook on branch pipe outlets illustrating and explaining the various steps of installation by the WeldOlet method. Types of these fittings available for various applications are shown.

Pumps. Kobe, Inc., Huntington Park, Calif.—Service manual giving complete directions for the maintenance of Triplex pumps and power units manufactured by this company. Included in this booklet are specifications, capacities, with tables showing horsepower output under various conditions.

Resins. American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.—24-page illustrated booklet describing the many applications of Melamine in the plastics, textile, paper, leather, chemical, paint and allied industries. This is a non-technical booklet relating to the various applications of Melamine and the chemical compounds in which it is used.

Stains. Chadeloid Corp., Dayton, Ohio—10-page booklet describing Chadeloid stains, using aniline dyes, ethylene glycol ethers, alcohols, and other similar materials. Various uses of these stains are covered in this bulletin.

Steam Engines. Troy Engine & Machine Co., Troy, Pa.—Bulletin No. 306. 4-page booklet describing the vertical type steam engine manufactured by this company. Construction details, together with a table of specifications, are included.

Steam Specialties. J. E. Lonergan Co., 2nd and Race Sts., Philadelphia 6, Pa.—Bulletin 502B. 4-page leaflet describing pressure safety appliances made by this company, which include safety valves, relief valves, pressure gages and other specialties.

Storage Facilities. The Nicholson Co., Inc., 10 Rockefeller Plaza, New York 20, N. Y.—32-page booklet illustrating and describing the engineering and construction of all types of bulk storage and handling installations. The types of storage structures employed in a number of different industries for use on all types of bulk materials are shown.

Synthetic Rubber. B. F. Goodrich Co., Akron, Ohio—Catalog Section 8000. 8-page booklet outlining the properties and uses of Ameripol D compound which is an oil resisting and heat resisting synthetic rubber. Tables are given comparing the property relations of natural and synthetic rubber.

Tube Cleaners. Thomas C. Wilson, Inc., 47-28 Thirty-seventh St., Long Island City, N. Y.—Catalog No. 42. 36-page catalog illustrating and describing this company's line of tube cleaners operated by air, steam, water and electricity. Selection data together with a chart of tube cleaner sizes for various sizes of tubes are included.

Valves. The Wm. Powell Co., 2503-31 Spring Grove Ave., Cincinnati 22, Ohio—16-page booklet containing information on valves—their selection, design, construction, application, and maintenance.

Water Treatment. American K.A.T. Corp., 331 Madison Ave., New York 17, N. Y.—Bulletin 33. 4-page leaflet discussing the all-colloidal water treatment service offered by this company.

Wire Cloth. Newark Wire Cloth Co., 351-365 Verona Ave., Newark, N. J.—116-page handbook of information on the wire screen and wire cloth products manufactured by this company. Various kinds of useful information, include a glossary of terms, and data on selection methods, ordering, testing, etc. Several pages of this booklet are devoted to engineering information and data. Catalog C.

CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

CUTS IN MILITARY REQUIREMENTS AFFECT PRODUCTION AND DISTRIBUTION OF CHEMICALS

With the closing of ordnance plants there has been a drop in total production of chemicals in the last two or more months. Some of the privately operated plants also have cut down operations and chemical production has reached a point where it is directed toward serving a greatly reduced buying for war needs and a much higher demand for civilian goods. Military requirements will not be cut to the prewar levels, or at least not for a long period, so we will start the peacetime era with a larger-than-normal demand from these government agencies to which will be added civilian orders estimated at varying percentages of increase over prewar standards.

While cutbacks and cancellations of war orders should have no effect on general industrial activities, actually they extend throughout industry for much of what is termed industrial output actually is consumed somewhere in the war effort. Hence the elimination of wartime buying will be felt rather widely and this already is noted in the case of production and distribution of chemicals and of finished products for which chemicals are raw materials.

Just as at the approach of war it was apparent that production of many chemicals would have to be greatly expanded so with the termination of the war it is equally apparent that such production must be curtailed. This curtailment now is in progress and will mean some change in the type of chemicals produced. For instance ammonia, nitric acid, toluol and other chemicals essential for turning out ammunition are sure to feel immediately the effects of reduced markets and for some time at least there is but little promise that this loss will be made up by enlarged demands from other directions.

Alcohol is another product which will lose ground through the drop in munitions production with its most pressing problem resting on the question of how much synthetic rubber is to be made and how much of this is come from butadiene made from petroleum. In fact future production of alcohol is of interest because with the passing of price controls, high price producers will find it difficult to maintain their position and as supplies of black-strap molasses may not be available in normal amounts, there is some interest regarding how and from what, alcohol is to be made in the next few years.

Prior to the war toluol was produced exclusively from coal-tar but the large war use for this chemical could not be met from coal-tar production alone and the petroleum industry again came to the rescue through a method of recovering toluol from crude oil. Here again there was interest to find out if the synthetic production was merely a wartime development or if it would compete for a place in postwar markets. One of the largest synthetic producers has answered this question by making its output available for peacetime uses.

Airplane, ship, and munitions manufacture have been on such a huge scale that to limit production to a point in line with normal requirements can not fail to react upon the markets for a varied line of raw materials. In the same way, the outlook for industrial consumption of chemicals is dependent on the maintenance of some civilian industries at close to the levels reached in the war years. This has special reference to the fertilizer industry because it increased rapidly in order to make possible the food program of the war years and because it offers such a wide outlet for basic chemicals. Food of all kinds will be needed for a long time to come or until such time as much of the burden of production can be borne by outside countries.

Chem. & Met. Index for Industrial Consumption of Chemicals

1935 = 100

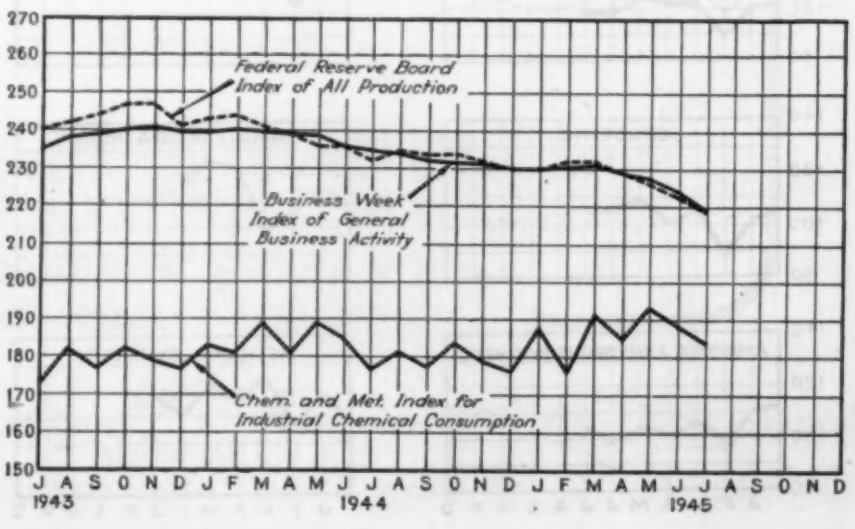
	June revised	July
Fertilizers	42.17	42.14
Pulp and paper	19.20	18.75
Petroleum refining	19.26	20.14
Glass	19.03	19.45
Paint and varnish	19.00	17.10
Iron and steel	12.43	12.73
Rayon	18.87	17.78
Textiles	10.48	9.38
Coal products	9.54	9.10
Leather	4.55	4.25
Industrial explosives	5.67	5.40
Rubber	3.00	3.00
Plastics	5.00	5.00
	188.61	184.22

In the meantime, the domestic chemical industry will be concerned with how close to wartime levels the fertilizer industry will operate. Last year fertilizer manufacturers consumed more than 2,600,000 tons of 100 percent sulphuric acid. In 1941, fertilizer consumption of the acid was about 1,550,000 tons. Probabilities are that wartime standards will be closely approximated but it would make a big difference if, instead, the prewar levels should be reached.

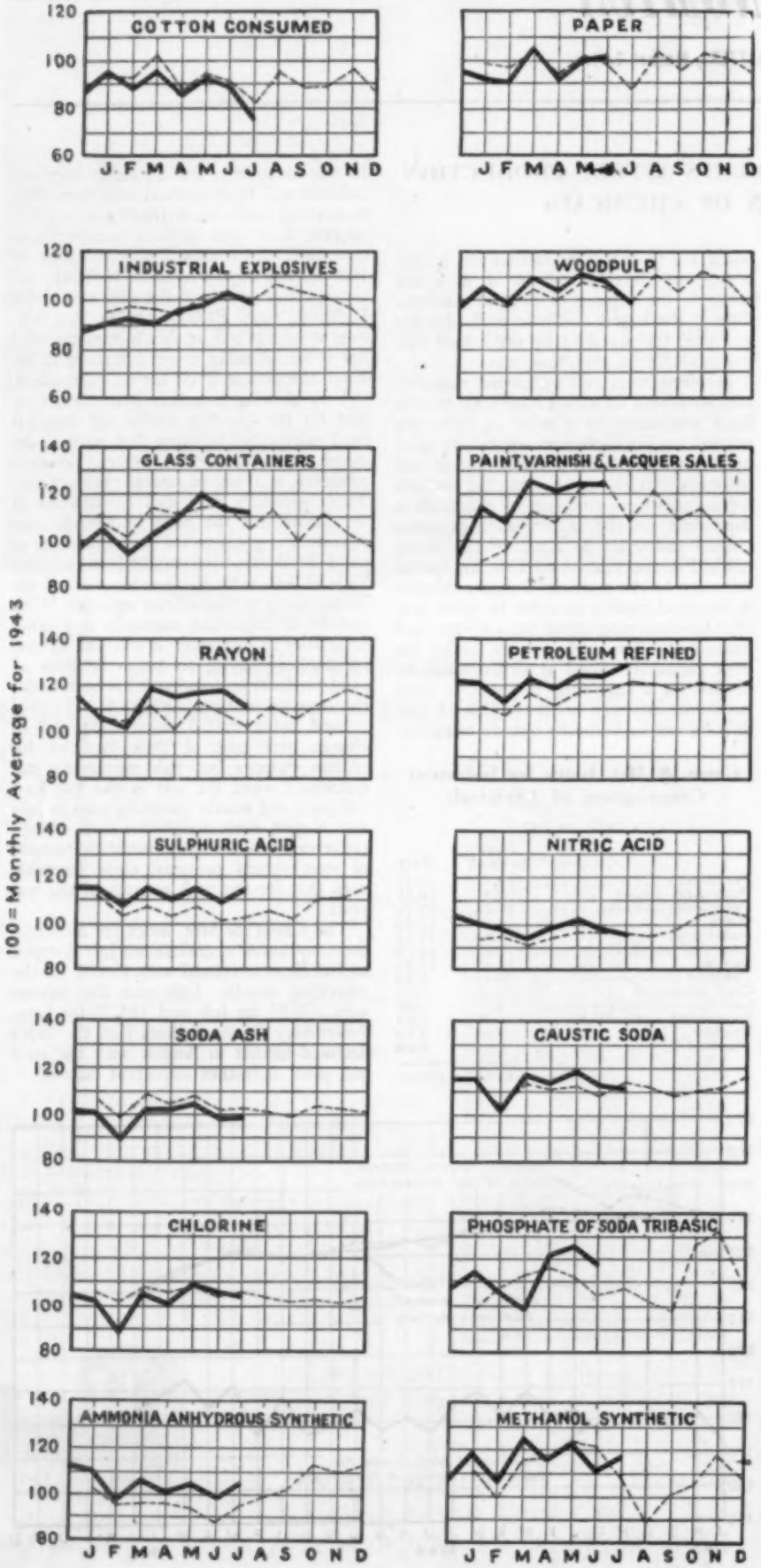
Very glowing prospects have been foretold for the building trades and this has been interpreted to mean that postwar demand for paints, varnishes, and kindred products will be of record proportions. These prospects may well be attained in the future but the most immediate consideration is given to the fact that sales of paint products have reached an all-time high of late with the greater part of deliveries going to the military agencies. With scarcity of important materials and other difficulties to overcome, it will not be easy for civilian buying to keep the flow of paint products up to what it has been under the stress of wartime buying.

Steel mills started some time ago to change over part of their facilities for civilian outputs but this movement was quickened when the war in the Far East collapsed and weekly operating rates in July and August were sharply lowered. When conversion has been completed the output of steel should compare more favorably with that for the peak months of the war years.

The Chem. & Met. index for industrial consumption of chemicals for July dropped to 184.22 as compared with 188.61 for the preceding month. Last year the indexes were 176.63 for July and 185.29 for June. Preliminary figures indicate that the index declined further in August with the steel and paint industries important factors.



PRODUCTION AND CONSUMPTION TRENDS



THE MOVEMENT toward reconversion which started some time ago and the acceleration of this movement after the war was over, have resulted in a drop in activities in most of the industries which are large consumers of chemicals. This can hardly be called a trend since it is a condition where temporary influences are important. However, with few exceptions, ordinary manufacturing lines have not been expanded much because of wartime demands for their products and full operation should be required to meet consuming demands with the backlog of civilian requirements offsetting any losses of military orders. In the meantime a period of adjustment may be expected to continue with some lines quickly swinging back to the levels maintained in recent months, that is to say at close to their wartime peaks.

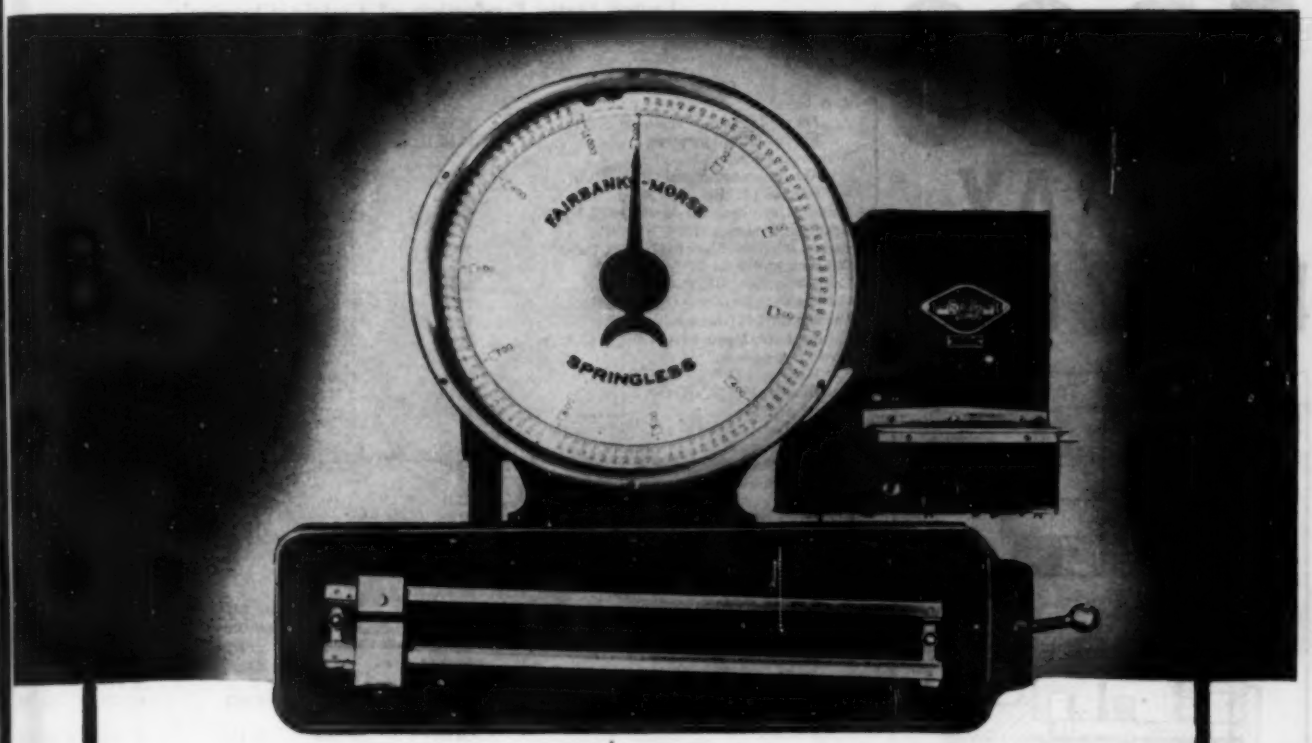
In production in general, the biggest factor at present is reconversion. The closing of many war plants and change over from war to peacetime facilities naturally have combined to bring down the production indexes. In the chemical industry, outside of the government-owned plants, the problem of reconversion has been relatively simple and has been concerned more with the change in consumers plants rather than in the plants producing chemicals.

The War Production Board has completed a survey which shows that by the end of this year the country's key industries expect production to be slightly over 100 percent of the 1939-41 base period in terms of dollars and employment to be slightly under 100 percent of the same base period. Moreover they expect both the production and employment figures to be climbing above those levels by the middle of 1946, in fact they think production may skyrocket to 187 percent with employment up to 133 percent of the base period.

With the close of the war, building programs which included plants of potential importance as consumers of chemicals, naturally were discontinued. Government financial aid has been withdrawn from a plant on the Pacific Coast which was intended to produce ethyl alcohol from wood waste. Sponsorship of four proposed guayule rubber mills in California was withdrawn by WPB. Three projects intended to increase the output of channel black were cancelled.

While some chemicals and other raw materials still are under allocation controls, there has been a fairly widespread lifting of such controls and the movement of goods is becoming more a matter of supply and demand. Even in the case of wood pulp, the situation has improved to a point where the industry advisory committee has recommended that controls and allocations be discontinued as of October 1.

Consumers of rosin who have been handicapped in obtaining supplies have been helped by amending the order governing this material and quotas have been at least doubled for a list of uses which include soap, paper, oils and greases, and most of the industries which are regular consumers.



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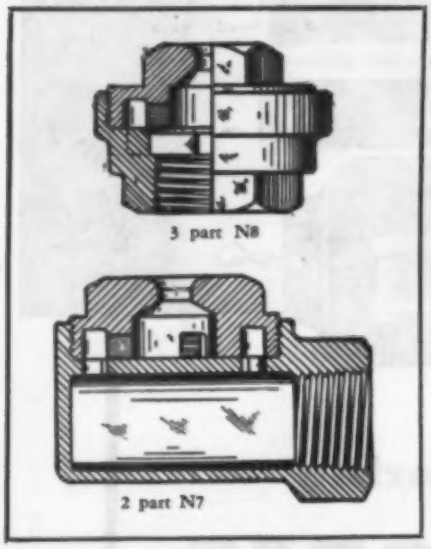

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United States Production of Certain Chemicals

June 1945, June 1944 and Six-Month Totals for 1945 and 1944

Chemical and Basis	Units	June 1945	June 1944	Total, First 6 Months 1945	Total, First 6 Months 1944
Acetylene:					
For use in chemical synthesis	M cu. ft.	311,832	322,750	1,922,222	1,948,858
For commercial purposes	M cu. ft.	124,440	129,715	805,735	855,485
Aluminum chloride:					
Anhydrous and crystal (100% $AlCl_3$)	M lb.	5,086	.....	30,774	.....
Solution (32° Be)	M lb.	945	.....	6,174	.....
Ammonia, synthetic anhydrous (100% NH_3)	Tons	45,072	40,071	283,705	258,282
Ammonium chloride (100% NH_4Cl)	M lb.	5,000	.....	32,800	.....
Barium sulphate (Blanc fixe) (100% $BaSO_4$)	M lb.	4,480	.....	28,868	.....
Bleaching power (35–37% avail. Cl_2)	M lb.	2,142	3,115	14,321	30,963
Calcium acetate (80% $Ca(C_2H_3O_2)_2$)	M lb.	658	888	3,834	6,039
Calcium arsenate (100% $Ca_3(AsO_4)_2$)	M lb.	5,157	7,401	15,222	26,280
Calcium carbide (commercial)	Tons	63,134	.....	373,790	.....
Calcium hypochlorite (true) (70% avail. Cl_2)	M lb.	1,181	1,032	7,601	7,068
Calcium phosphate:					
Monobasic (100% $CaH_4(PO_4)_2$)	M lb.	4,806	4,165	30,798	29,283
Dibasic (100% $CaHPO_4$)	M lb.	2,593	.....	20,911	.....
Carbon, activated	M lb.	5,257	.....	30,854	.....
Carbon black (channel):					
Rubber grade	M lb.	40,524	.....	227,137	.....
Other than rubber grade	M lb.	2,776	.....	15,812	.....
Carbon dioxide:					
Liquid and gas	M lb.	18,495	31,506	106,370	169,987
Solid (dry ice)	M lb.	66,423	64,759	330,191	298,141
Chlorine	Tons	106,699	104,401	623,994	636,724
Chrome green (C.P.)	M lb.	351	565	2,894	3,107
Chrome yellow and orange (C.P.)	M lb.	3,223	.....	20,094	.....
Copper acetoarsenite (Paris green)	M lb.	375	.....	2,586	.....
Hydrochloric acid (100% HCl)	Tons	37,348	30,607	218,562	178,308
Hydrogen	M cu. ft.	2,156,000	1,966,000	12,533,000	11,871,000
Hydrogen peroxide (100 volumes)	M lb.	2,627	.....	16,055	.....
Iron blue (C.P.)	M lb.	774	.....	4,747	.....
Lamp black	M lb.	1,375	.....	7,414	.....
Lead arsenate (acid and basic)	M lb.	5,485	6,573	47,518	51,798
Lead oxide:					
Red (C.P.)	M lb.	8,909	8,413	59,689	53,616
Yellow (C.P.)	M lb.	27,654	.....	168,113	.....
Methanol:					
Natural (80% CH_3OH)	M gal.	313	341	1,858	2,131
Synthetic (100% CH_3OH)	M gal.	6,012	6,563	38,178	37,273
Molybdate chrome orange (C.P.)	M lb.	130	95	782	717
Nitric acid (100% HNO_3)	Tons	39,062	39,275	240,378	228,687
Nitrous oxide	M gal.	13,273	10,225	75,695	58,616
Oxygen	M cu. ft.	1,233,025	1,535,241	8,183,517	9,529,625

(Continued on page 282)

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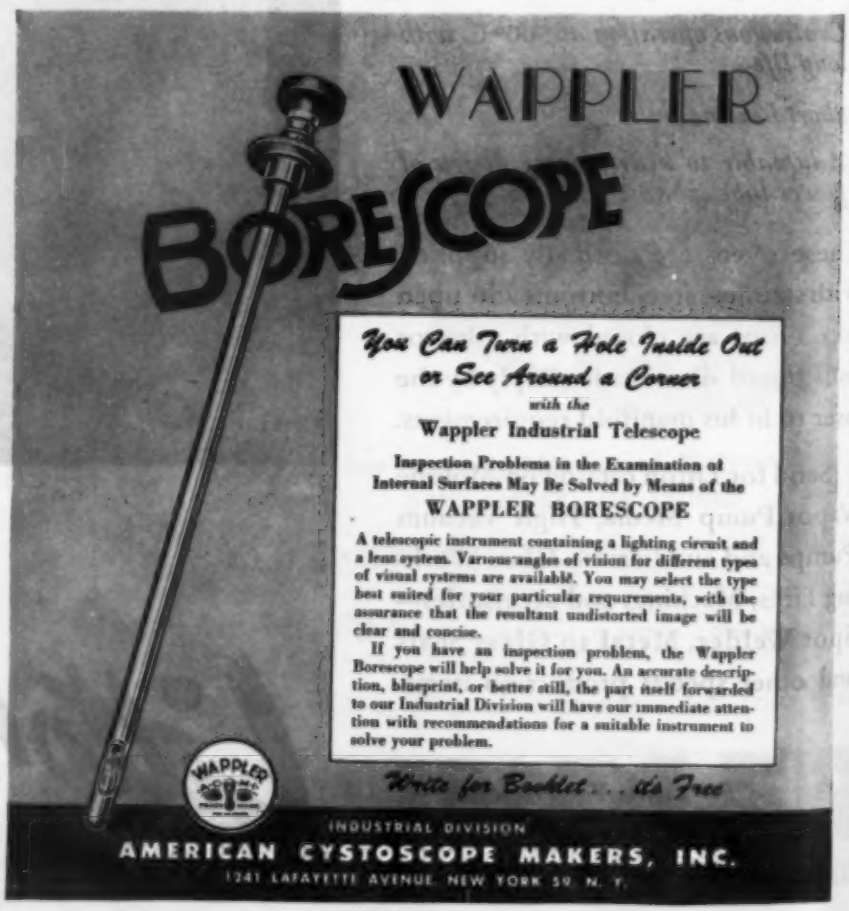
U. S. Chemical Production (Cont. from p. 280)

Chemical and Basis	Units	June 1945	June 1944	Total, First 6 Months 1945	Total, First 6 Months 1944
Phosphoric acid (50% H_3PO_4)	Tons	61,494	55,531	335,915	304,850
Potassium bichromate and chromate (100%)	M lb.	434	603	3,479	4,127
Potassium hydroxide (100% KOH)	Tons	4,751	3,745	26,748	21,911
Soda ash (commercial sodium carbonate):					
Ammonia-soda process (98–100% Na_2CO_3):					
Total wet and dry[3]	Tons	358,782	371,754	2,205,252	2,307,869
Finished light[3]	Tons	189,444	202,806	1,181,578	1,263,312
Finished dense	Tons	115,675	115,940	691,997	728,442
Natural[4]	Tons	15,980	14,711	91,477	87,746
Sodium bicarbonate (refined) (100% $NaHCO_3$)	Tons	13,954	14,711	85,490	82,940
Sodium bichromate and chromate (100%)	Tons	5,951	6,690	40,215	42,298
Sodium bisulphite (100% $NaHSO_3$)	M lb.	3,665	.....	19,580	.....
Sodium hydrosulphide (100% NaSH)	M lb.	2,099	.....	13,023	.....
Sodium hydrosulphite (100% $Na_2S_2O_4$)	M lb.	3,152	.....	19,076	.....
Sodium hydroxide (100% NaOH):[5]					
Electrolytic process:					
Liquid	Tons	101,461	100,747	690,732	596,509
Solid	Tons	19,128	.....	112,889	.....
Lime-soda process:					
Liquid	Tons	56,974	54,536	375,689	338,638
Solid	Tons	21,382	.....	122,410	.....
Sodium phosphate:					
Monobasic (100% NaH_2PO_4)	Tons	1,244	2,422	7,306	14,435
Dibasic (100% Na_2HPO_4)	Tons	5,621	4,600	28,788	27,899
Tribasic (100% Na_3PO_4)	Tons	7,198	6,337	41,479	39,497
Meta (100% $NaPO_3$)	Tons	2,466	.....	13,195	.....
Tetra (100% $Na_4P_2O_7$)	Tons	3,631	.....	18,823	.....
Sodium silicate: soluble silicate glass, liquid and solid (anhydrous)	Tons	43,733	.....	233,561	.....
Sodium sulphate:					
Anhydrous (refined) (100% Na_2SO_4)	Tons	5,715	5,228	40,029	41,153
Glaubers salt (100% $Na_2SO_4.10H_2O$)	Tons	19,332	66,625	110,066	308,819
Salt cake (crude) (commercial)	Tons	42,207		270,503	
Sulphur dioxide	M lb.	6,879	6,448	38,807	37,436
Sulphuric acid (100% H_2SO_4):[6]					
Chamber process	Tons	234,975	236,879	1,636,467	1,618,326
Net contact process[6]	Tons	481,561	437,959	2,987,242	2,500,581
White lead:					
Basic lead carbonate (C.P.)	Tons	3,340	.....	20,436	.....
Basic lead sulphate (C.P.)	Tons	1,091	.....	5,935	.....
Zinc yellow (zinc chromate) (C.P.)	Tons	1,520	.....	9,783	.....

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census and WPB Chemicals Bureau. Production figures represent primary production and do not include purchased or transferred material. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry not included. Chemicals manufactured by TVA, however, are included. All tons are

(Footnotes continued on p. 284)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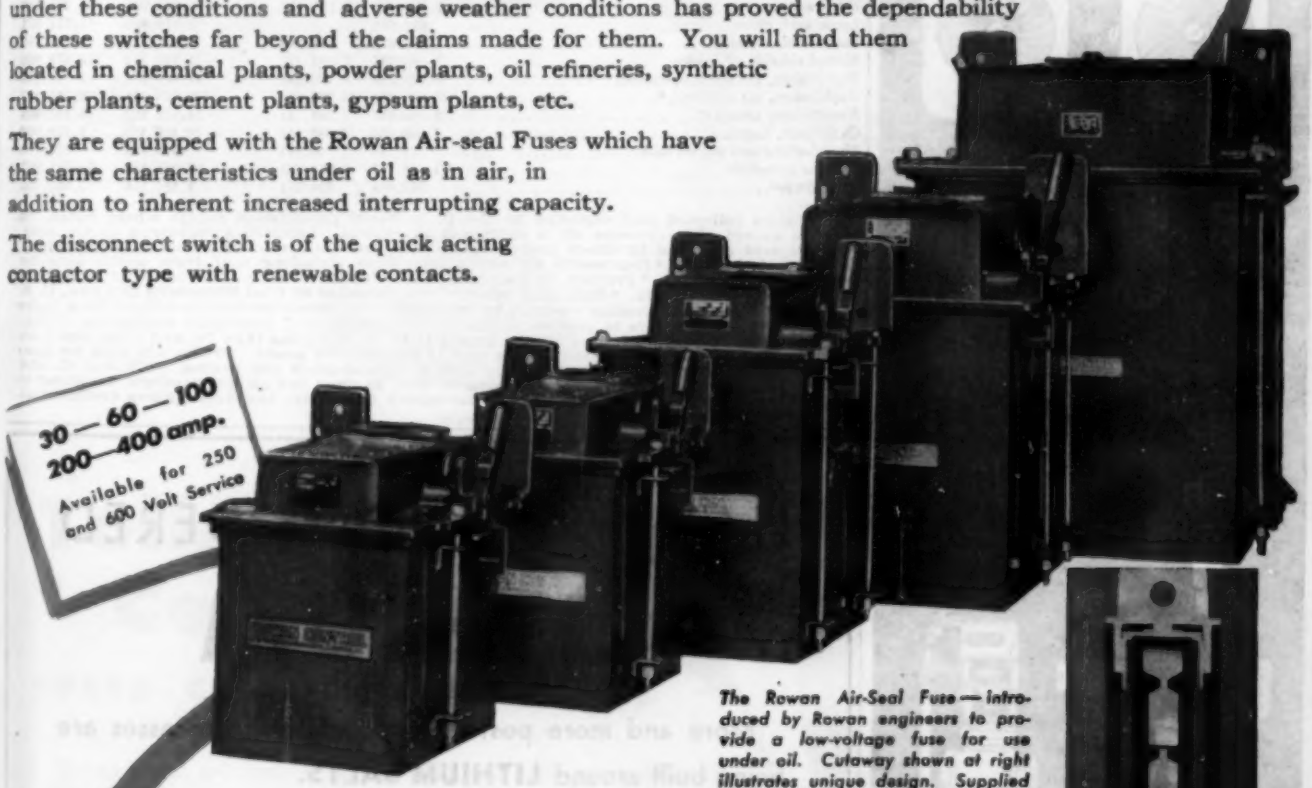

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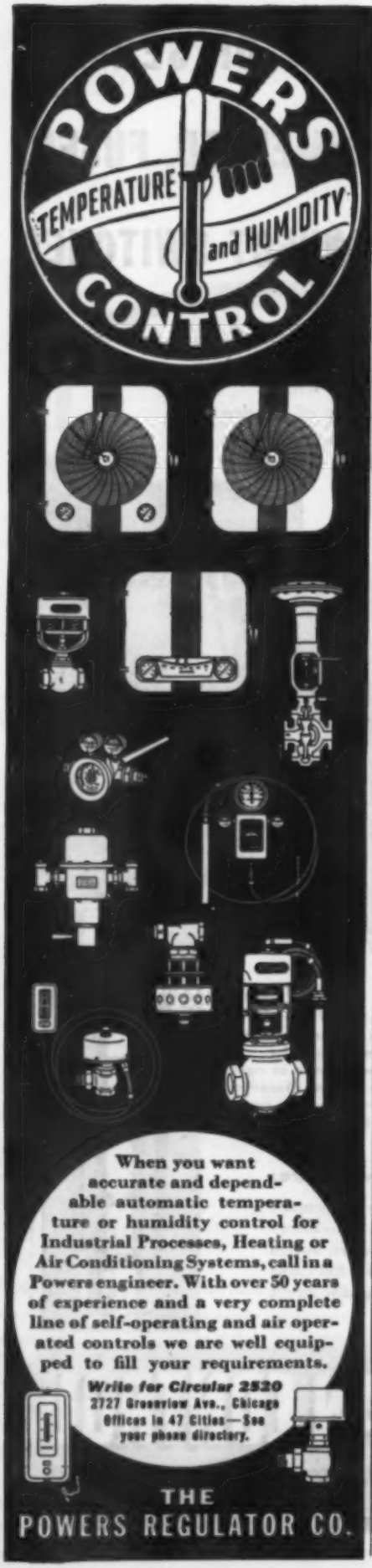
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When you want accurate and dependable automatic temperature or humidity control for Industrial Processes, Heating or Air Conditioning Systems, call in a Powers engineer. With over 50 years of experience and a very complete line of self-operating and air operated controls we are well equipped to fill your requirements.
Write for Circular 2520
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Offices in 47 Cities—See your phone directory.
THE
POWERS REGULATOR CO.

U. S. Chemical Production (Cont. from p. 282)

2,000 lb. Where no figures are given, data are either confidential or not yet available. [1] Includes a small amount of aqua ammonia. [2] Total wet and dry production including quantities diverted for manufacture of sodium bicarbonate and caustic soda and quantities processed to finished light and finished dense. [3] Not including quantities converted to finished dense. [4] Data collected in cooperation with the Bureau of Mines. [5] Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6] Include oleum grades. Excludes spent acid.

United States Production of Certain Synthetic Organic Chemicals

June 1945, June 1944 and Six-Month Totals for 1945 and 1944

Item	June 1945	June 1944	Total, First 6 Months 1945	Total, First 6 Months 1944
Acetanilide, technical and U. S. P.	.....	.....	†2,406,281	*2,748,753
Acetic acid, synthetic[1]	23,358,276	22,994,169	141,886,923	149,440,364
Acetic acid, natural[2]	2,991,009	3,308,389	17,928,801	20,375,074
Acetic anhydride[3]	46,413,796	40,048,345	272,800,318	244,031,952
Acetylsalicylic acid, aspirin	882,853	744,251	5,382,625	4,587,476
n-Butyl acetate	4,874,256	6,124,667	35,511,686	37,961,120
Creosote oil, tar distillers[4]	10,743,983	10,156,706	67,356,007	65,908,423
Creosote oil, byproduct[5, 6]	2,871,196	3,568,836	18,716,915	19,907,712
Cresols, meta-para[7]	362,148	531,606	3,961,858	3,611,384
Cresols, ortho-meta-para[7]	1,466,427	866,565	*4,689,031	4,698,299
Cresylic acid, crude	2,274,887	1,951,678	13,624,818	12,321,648
Cresylic acid, refined[7]	2,076,816	3,257,439	15,064,725	20,591,576
Diethyl ether	7,460,412	4,619,999	47,769,273	30,316,477
Ethyl acetate	7,902,437	8,772,412	55,041,790	53,768,508
Lactic acid, edible	422,061	.....	2,519,403	*1,771,573
Lactic acid, technical	256,653	374,340	2,318,917	1,754,186
Methyl chloride, all grades	2,785,187	2,001,151	15,162,312	10,673,906
Naphthalene, coke-oven operators[8, 9]	7,559,767	8,230,393	45,319,288	52,786,075
Naphthalene, tar distillers[8, 9]	16,276,648	15,725,696	100,588,838	96,541,367
Naphthalene, refined[10]	5,980,097	7,204,741	34,832,262	45,167,463
Oxalic acid, technical	1,680,660	1,584,652	10,195,433	8,958,093
Phenobarbital and sodium salts	21,199	20,171	145,585	134,779
Phthalic anhydride	11,802,442	9,664,363	67,015,450	60,211,887
Sulfa drugs[11]	542,678	234,014	2,881,114	3,040,105

Statistics collected and compiled by the U. S. Tariff Commission except where noted. In pounds except that creosote oil is expressed in gallons. [1] Excludes recovered acetic acid. [2] Acetic acid produced by direct process from wood and from calcium acetate. Compiled by Bureau of Census. [3] Represents all acetic anhydride including that from acetic acid by vapor-phase process. [4] Product of distillers of purchased tar only. [5] Product of byproduct coke-oven operators only. [6] Statistics collected and compiled by Coal Economics Division, U. S. Bureau of Mines. [7] Statistics reported by byproduct coke-oven operators combined with those reported by tar distillers to prevent disclosure of operations of individual companies. [8] Statistics combine three grades: solidifying at less than 74; 74 to less than 76; and 76 to less than 79 deg. C. [9] Production for sale only in case of less than 74 grade. Production both for consumption within producing plant and for sale in case of other two grades. [10] 79 deg. C. and over. [11] Includes data for acetylsulfathiazole, both as drug and as intermediate, resulting in appreciable unavoidable duplication. † Four-month total, Jan. and June figures confidential. * Five-month total.

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More and more postwar products and processes are being built around **LITHIUM SALTS.**

Their low molecular weight, low melting eutectics with other compounds, high capacity for moisture and CO_2 absorption are making them a **MUST** for today's research

BROMIDE — NITRATE
CHLORIDE — FLUORIDE
CARBONATE — HYDROXIDE

METALLOY CORPORATION
RAND TOWER — MINNEAPOLIS, MINN.

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1,000,000 YEARS IN THE MAKING

to this

IN A MATTER OF HOURS

Tolhurst Centrifugals

SPEED CHEMICAL PROCESSES

SEPARATING by centrifugal force in the conversion of coal tar into its many by-products is only one of the methods by which Tolhurst Centrifugals speed up production in the chemical industries. Whenever the processing requires dehydrating, draining, filtering, thickening or separating, *centrifugal force* can do the job faster because Tolhurst Centrifugals multiply the force of gravity from a few hundred to a thousand times, depending upon the requirements of the process. Tolhurst economies accrue from many sources. Among them are easier material handling, savings in time, steam, heat, filtering mediums, wash liquids, pumping equipment, press frames and floor space. Write for interesting literature today

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American Machine and Metals, Inc., East Moline, Illinois

Do you have a tank, kettle or bath of acid, alkali or salt whose concentration is of interest to you?

TO MEASURE:

A **Solu-Bridge,** and a simple conductivity cell immersed in the solution will enable you to measure its concentration in a few seconds.

TO CONTROL:

For automatic control of the solution strength, a **Solu-Bridge Controller,** a conductivity cell and a solenoid valve are necessary.

Model RE-C4 Solu-Bridge Controller

On request we shall be pleased to prepare a specific recommendation for you and a quotation on a complete installation for measurement, automatic control or automatic control and recording.

Industrial Instruments

PLANT and OFFICES:

17 POLLACK AVENUE

JERSEY CITY 5, N. J.

Byproducts Obtained From Coke-Oven Operations in the United States in 1944

(Exclusive of Screenings or Breeze)

Product	Unit	Production	Sales Quantity	Sales Value Total	Sales Value Average
Tar	Gal.	767,807,171	407,189,447	$21,897,933	$0.05
Tar derivatives:					
Creosote oil, distillate as such	Gal.	31,849,034	31,931,611	3,855,798	.12
Creosote oil in coal-tar solution	Gal.	11,930,287	10,493,286	1,237,190	.11
Tar acid oil	Gal.	13,432,236	13,405,255	1,582,551	.11
Pitch of tar: Soft[2]	Tons	379,671	52,641	571,631	10.85
Hard[3]	Tons	289,353	23	506	22.00
Other tar derivatives				1,998,544	
Ammonia:					
Sulphate	Lb.	1,636,487,509	1,553,923,139	19,828,483	.01
Liquor (NH_3 content)	Lb.	63,329,672	60,008,642	1,914,785	.03
				21,743,268	
Sulphate equivalent of all forms	Lb.	1,869,806,197	1,793,957,707		
NH_3 equivalent of all forms	Lb.	472,451,556	448,489,426		
Gas:					
Used under boilers, etc.	M cu. ft.	1,008,799,926	40,665,072	3,511,320	.08
Used in steel or affiliated plants	M cu. ft.		374,379,422	41,080,953	.11
Distributed through city mains	M cu. ft.		170,313,905	44,694,854	.26
Sold for industrial use	M cu. ft.		35,803,212	4,835,273	.13
		[4]1,008,799,926	621,161,611	94,122,400	.15
Light oil and derivatives:					
Crude light oil	Ga	[5]267,861,984	21,872,366	1,817,804	.08
Benzol:					
All grades except motor	Gal.	146,909,883	145,106,318	19,021,111	.13
Motor	Gal.	18,556,555	17,289,409	1,347,410	.08
Xylol, crude and refined	Gal.	8,668,740	8,903,131	2,283,754	.25
Solvent naphtha	Gal.	5,564,012	5,348,188	787,481	.14
Other light oil products	Gal.	42,737,493	38,902[6]220	9,400,465	.24
		[5]222,436,683	237,481,632	34,918,025	.14
Naphthalene, crude	Lb.	103,041,023	103,839,780	2,094,506	.02
Carbolic oil, light and heavy	Gal.	1,476,828	1,479,604	155,492	.10
Pyridine: Crude	Gal.	485,261	434,442	304,530	.70
Refined	Gal.	135,091	135,180	471,814	3.49
Picoline	Gal.	104,832	103,714	131,366	1.26
Sodium phenolate	Gal.	3,317,770	3,212,981	186,965	.05
Other byproducts[7]				722,633	
Value of all byproducts sold				[8]185,995,242	

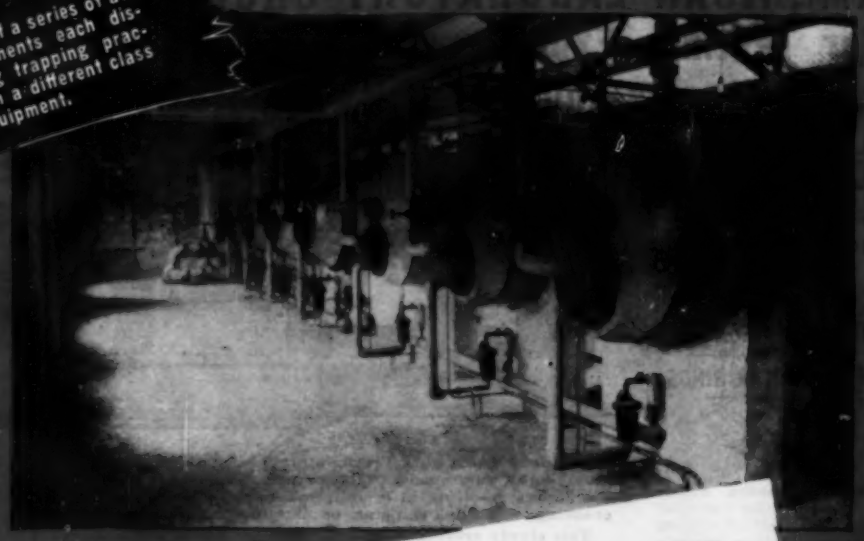
[1] Data from U. S. Bureau of Mines. Includes products of tar distillation conducted by coke-oven operators under same corporate name. [2] Softening point less than 110 deg. F. [3] Softening point over 160 deg. F. Includes some medium pitch of tar reported by one producer. [4] Includes gas used for heating ovens and gas wasted. [5] Refined on premises to make derived products shown: 259,544,535 gal. [6] Total gallons of derived products. [7] Ammonium thiocyanate, cyanogen sludge, dicyclopentadiene, hexane, phenol from sources other than tar distillation, residuals, sodium prussiate, sulphur, and vented vapors. [8] Exclusive of value of breeze production which was $13,281,342 in 1944.

Lee corrosion-resistant equipment is famous for its wide variety of standardized shapes and sizes, immunity to food acids, brilliant - smooth easy-to-clean surfaces, economy, efficiency, safety, extraordinary toughness and strength—equipment that will do your job *better* and *faster.*

LEE METAL PRODUCTS COMPANY INC.

415 PINE STREET · PHILIPSBURG, PA.

One of a series of advertisements each discussing trapping practice on a different class of equipment.



HOW TO TRAP

SUBMERGED COILS AND TUBES

. . . for higher temperatures

Trapping Tips* on Submerged Coils

- Use a trap on each unit.
- Install trap close to and below unit being drained.
- Use traps that automatically discharge air along with condensate.
- Use traps that discharge condensate at steam temperature.
- For extra fast heating, use traps with extra air handling capacity.
- Use adequate safety factor to handle peak loads.

*The ARMSTRONG STEAM TRAP BOOK contains complete data on trap selection including calculation of condensation and heat transfer rate plus recommended safety factors. Ask for a copy.

Packing Company Cuts Cooking Time 57%

Selection of steam traps for efficient drainage of condensate from evaporators, storage and instant water heaters, reboilers, ammonia generators, oil tank heaters, and simple open tank heating coils requires *experience* as well as engineering theory. Factors such as circulation, condition of coils, etc., have such a marked effect on condensation rates that calculations are complex and sometimes useless. Armstrong has unequalled experience required for solving these problems—gained on thousands of installations. That's why Armstrong users get results like these:

Duluth Company cuts cooking time 57% —from 8 down to 3½ hours.

Canadian cannery eliminates need for extra boiler after installing 7 traps.

Plating company increases production, improves quality of work, saves coal.

Chemical company saves $25 per day on fuel.

For a survey of your needs, address: ARMSTRONG MACHINE WORKS, 858 Maple St., Three Rivers, Michigan.

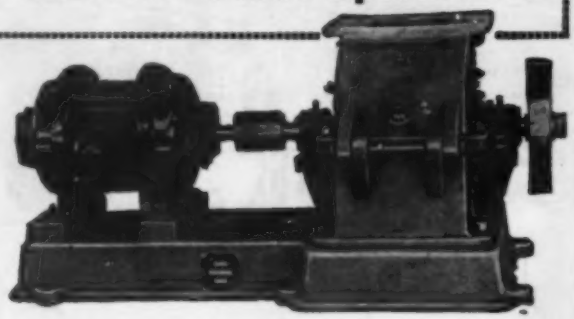
ARMSTRONG *Inverted Bucket* STEAM TRAPS

Over a Million in Use...For Power...Process...Heating

AMERICAN LABORATORY CRUSHERS for Testing, Experimental and Research Laboratories and Pilot Plant Operations

Duplicates large crusher conditions and operations—

PATENTED MANGANESE STEEL SHREDDER RINGS



American Crushers exclusively employ the Shredder Rings with their 20 cutting edges that reduce materials by splitting instead of crushing. They deflect in contact with tramp metal—eliminating shear pins and conventional safety devices that require attention.

American Laboratory Crushers provide a rapid, wide range reduction of amorphous, friable or fibrous materials of various hardnesses resulting in a uniform product from appropriate crushing, splitting, chipping or shredding actions.

This sturdy crusher is custom-made for use in series operations with blowers and collectors, feed and discharge conveyors, pre-crusher circuits, bucket elevators or as a one-step floor or table mounted unit. Capacities of 100 to 2000 lbs per hour.

Our engineers and testing laboratories are at your service to make recommendations based on product samples and particulars sent us.

Send for Informational Bulletin

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1219 Macklind Ave. St. Louis 10, Mo.

A PUMP VALVE WITH 1000 SEATS

EACH TURN...EACH SWING...A PERFECT SEAT

ROYAL CROWN PUMP VALVES are ball guided . . . they revolve, swing and take a new seat at each stroke of the pump. Royal Crown Valves are machined to true balance . . . they are light and buoyant . . . only three trouble-free parts. No springs, clips or keys . . . no straight guide to wear and bind. Extreme temperatures or pressures *cannot* reduce Royal Crown efficiency. A wide range of sizes in any alloy metal for either thread or press fit. *Write for illustrated catalog.*

ROYAL CROWN VALVES

MADSEN IRON WORKS • HUNTINGTON PARK, CALIF.

CHEM. & MET.
Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

This month	108.75
Last month	108.75
September, 1944	109.37
September, 1943	109.03

CURRENT PRICES

The accompanying prices refer to round lots. Where, it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to September 10

INDUSTRIAL CHEMICALS

Acetone, tanks, lb	$0.06 –
Acid, acetic, 28%, bbl., 100 lb	3.38 – $3.63
Boric, bbl., ton	109.00 –113.00
Citric, kegs, lb	.20 – .23
Formic, cbys., lb	.10½– .11
Hydrofluoric, 30%, drums, lb.	.08 – .085
Lactic, 44%, tech. light, bbl., lb.	.073– .075
Muriatic, 18°, tanks, 100 lb.	1.05 –
Nitric, 36°, carboys, lb	.05 – .05½
Oleum, tanks, wks., ton	18.50 – 20.00
Oxalic, crystals, bbl., lb	.11½– .12½
Phosphoric tech., tanks, lb	.04 –
Sulphuric, 60°, tanks, ton	13.00 –
Tartaric, powd., bbl., lb	.70½–
Alcohol, amyl	–
From pentane, tanks, lb	.131–
Alcohol, butyl, tanks, lb	.10½– .18½
Alcohol, ethyl, denatured, 190 proof	–
No. 1 special, tanks, gal., wks.	.50 –
Alum, ammonia, lump, lb	.04½–
Aluminum sulphate, com. bags 100 lb	1.15 – 1.49
Ammonia, anhydrous, cyl., lb	.14½–
tanks, ton	59.00 – 69.00
Ammonium carbonate, powd., tech., casks, lb	.09½– .12
Sulphate, wks., ton	28.20 –
Amyl acetate, tech., from pentane, tanks, lb	.145–
Aqua, ammonia, 26°, drums, lb	.02½– .03
tanks, ton	65.00 –
Arsenic, white, powd., bbl., lb	.04 – .04½
Barium, carbonate, bbl., ton	65.00 – 75.00
Chloride, bbl., ton	75.00 – 78.00
Nitrate, casks, lb	.09½– .11
Blanc fix, dry, bags, ton	60.00 – 70.00
Bleaching powder, f.o.b., wks., drums, 100 lb	2.50 – 3.00
Borax, gran, bags, ton	45.00 –
Calcium acetate, bags, 100 lb	3.00 –
Arsenate, dr., lb	.07½– .08
Carbide, drums, ton	50.00 –
Chloride, flake, bags, del., ton	18.50 – 25.00
Carbon bisulphide, drums, lb	.05 – .05½
Tetrachloride, drums, gal	.73 – .80
Chlorine, liquid, tanks, wks., 100 lb	1.75 – 2.00
Copperas, bgs., f.o.b., wks., ton	17.00 – 18.00
Copper carbonate, bbl., lb	.19½– .20
Sulphate, bbl., 100 lb	5.00 – 5.50
Cream of tartar, bbl., lb	.57 –
Diethylene glycol, dr., lb	.14½– .15½
Epsom salt, dom., tech., bbl., 100 lb	1.80 – 2.00
Ethyl acetate, tanks, lb	.11½–
Formaldehyde, 40%, tanks, lb	.032–
Furfural, tanks, lb	.09½–
Glaubers salt, bags, 100 lb	1.05 – 1.108
Glycerine, c.p., drums, extra, lb	.17½– .17½
Lead:	
White, basic carbonate, dry, casks, lb	.08½–
Red, dry, sck., lb	.09½–
Lead acetate, white crys., bbl., lb	.12½– .13
Lead acetate, powd., bag, lb	.11½– .12
Lithopone, bags, lb	.04½– .04½
Magnesium carb., tech., bags, lb.	.06½– .08½
Methanol, 95%, tanks, gal	.58 –
Synthetic, tanks, gal	.24 –
Phosphorus, yellow, cases, lb	.23 – .25
Potassium bichromate, casks, lb.	.10½– .10½
Chlorate, pwd., lb	.09½– .12
Hydroxide (c'stic potash) dr., lb	.07 – .07½
Muriate, 60%, bags, unit	.53½–
Nitrate, bbl., lb	.05½– .06
Permanganate, drums, lb	.19½– .20
Prussiate, yellow, casks, lb	.16 – .17
Sal ammoniac, white, casks, lb	.0515– .06
Salsoda, bbl., 100 lb	1.00 – 1.05
Salt cake, bulk, ton	15.00 –
Soda ash, light, 58%, bags, contract, 100 lb	1.05 –
Dense, bags, 100 lb	1.15 –
Soda, caustic, 76% solid, drums, 100 lb	2.30 – 3.00
Acetate, del., bbl., lb	.05 – .06
Bicarbonate, bbl., 100 lb	1.70 – 2.00
Bichromate, casks, lb	.07½– .08½
Bisulphate, bulk, ton	16.00 – 17.00
Bisulphite, bbl., lb	.03 – .04

★ *A few months ago we pictured in this publication a heavy-wall tee with a remarkably long outlet—so long in fact that a few of our friends were a little skeptical and implied that we had perhaps over-extended our poetic license, as well as the outlet, in retouching the photo.*

Well . . . this one, as you can plainly see, is not retouched. The tee was photographed before machining just to show what can be done with hot metal if you know how.

YES, "*if you know how.*" . . . And it will pay you to keep this matter of "know-how" in mind when you choose standard welding fittings. The need for unusual knowledge and highly specialized skills may be less apparent in regular fittings than in specials like this, but make no mistake: it is *no less essential.*

That is why we have cited this and many other unusual jobs which testify so eloquently to the "know-how" of Taylor Forge. This knowledge has enabled us to put into WeldELLS and other Taylor Forge welding fittings every feature wanted by everyone from the pipe designer to the welder.

In fact, you will see the evidences of this in every WeldELL . . . in the strength features like the selective distribution of extra metal where strains are greatest . . . in the convenience features like the tangents, the quarter-marked ends, the machine-tool bevels, the extremely accurate dimensions. Indeed, you will see that

WeldELLS have everything

WeldELLS alone combine these features:

- **Seamless**—greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement**—provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

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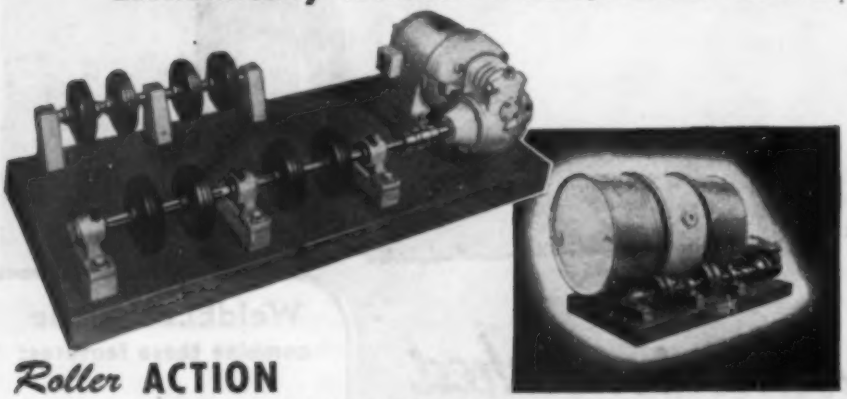
USE— This Better, Faster Way to Mix or Blend Chemicals, Liquids, Pigments

Mix in Supplier's Drums—Quickly, Economically Without Waste, Fuss or Bother



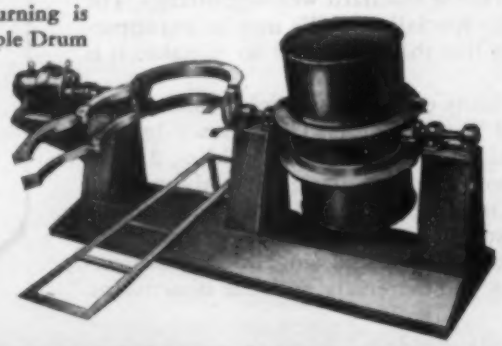
Roller ACTION

When mixing can best be done by revolving the container, use a "U.S." *adjustable* Drum Roller. Standard units are made to handle one to four 55-gallon drums up to 1000 lbs. load per drum. Eight heavy-duty rubber-tired wheels support each drum. The wheels are adjustable on the shaft to provide ample clearance for rolling hoops and bung openings. Drum speed is approximately 30 RPM. "U.S." *adjustable* Drum Rollers can be made to handle any size drum, barrel, or round container.

Tumbling ACTION

When tumble-mixing or churning is required, "U.S." single or multiple Drum Tumblers are a vast improvement over the old style "fixed-barrel" tumbler. It is only a matter of minutes to place the drum in position, fasten the adjustable yoke, and start the tumbling action. No delays from filling, emptying and cleaning a fixed barrel. Mix in the supplier's drums!

Standard Drum Tumblers are built in sizes to handle one, two or three 5-, 30- or 55-gallon drums. Tumbling speed is approximately 30 RPM for standard units, though on special order any desired tumbling speed can be furnished.



WRITE FOR *Special* LITERATURE TODAY

PROCESS EQUIPMENT DIVISION

Since 1865 **U. S. STONEWARE** *Akron, Ohio*

CHEM. & MET.
Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

This month	145.63
Last month	145.83
September, 1944	145.04
September, 1943	145.55

Chlorate, kegs, lb	$0.06½ –	$0.06½
Cyanide, cases, dom., lb	.14½ –	.15
Fluoride, bbl., lb	.07 –	.08
Hyposulphite, bbl., 100 lb	2.40 –	2.50
Metasilicate, bbl., 100 lb	2.50 –	2.65
Nitrate, bulk, 100 lb	1.35 –	
Nitrate, casks, lb	.06½ –	.07
Phosphate, tribasic, bags, lb	2.70 –	
Prussiate, yel., bags, lb	.06½ –	.10
Silicate, 40°, dr., wks., 100 lb	.80 –	.85
Sulphite, bbl., lb	.02½ –	
Sulphite, crys., bbl., lb	.02½ –	.02½
Sulphur, crude at mine, long ton	16.00 –	
Dioxide, cyl., lb	.07 –	.09
Dioxide, tanks, lb	.04 –	
Tin crystals, bbl., lb	.39½ –	
Zinc chloride, grain, bbl., lb	.05½ –	.06
Oxide, lead free, bag, lb	.07½ –	
Oxide, 5% leaded, bags, lb	.07½ –	
Sulphate, bbl., cwt	3.85 –	4.00
OILS AND FATS		
Castor oil, No. 3 bbl., lb	$0.13½ –	$0.14½
Chinawood oil, tanks, lb	.38½ –	
Coconut oil, ceylon, dr. N. Y., lb	.0885–	
Corn oil crude, tanks (f.o.b. mill), lb	.12½ –	
Cottonseed oil crude (f.o.b. mill), tanks, lb	.12½ –	
Linseed oil, raw, car lots, bbl., lb	.155–	
Palm, casks, lb	.0865–	
Peanut oil, crude, tanks (mill), lb.	.12½ –	
Rapeseed oil, refined, bbl., lb	nom.	
Soybean, tanks, lb	.11½ –	
Menhaden, light pressed, dr., lb	.13 –	
Crude, tanks (f.o.b. factory) lb.	.080–	
Grease, yellow, loose, lb	.08½ –	
Oleo stearine, lb	.09½ –	
Oleo oil, No. 1, lb	.11½ –	
Red oil, distilled, bbl., lb	.13 –	
Tallow extra, loose, lb	.08½ –	
COAL-TAR PRODUCTS		
Alpha-naphthol, crude, bbl., lb	$0.52 –	$0.55
Alpha-naphthylamine, bbl., lb	.32 –	.34
Aniline oil, drums, extra, lb	.11½ –	.12½
Aniline salts, bbl., lb	.22 –	.24
Benzaldehyde, tech., dr., lb	.45 –	.50
Benzidine base, bbl., lb	.70 –	.75
Benzoic acid, USP, kegs, lb	.54 –	.58
Benzol, 90%, tanks, works, gal	.15 –	
Benzyl chloride, tech., dr., lb	.22 –	.24
Beta-naphthol, tech., drums, lb	.23 –	.24
Cresol, USP, dr., lb	.10½ –	
Cresylic acid, dr., wks., gal	.81 –	.83
Diphenyl, bbl., lb	.15 –	
Diethylaniline dr., lb	.40 –	.45
Dinitrotoluol, bbl., lb	.18 –	.19
Dinitrophenol, bbl., lb	.22 –	.23
Dip oil, 15%, dr., gal	.23 –	.25
Diphenylamine, dr., f.o.b wks., lb.	.25 –	
H acid, bbl., lb	.45 –	.50
Hydroquinone, bbl., lb	.90 –	
Naphthalene, flake, bbl. lb	.07 –	.07½
Nitrobenzene, dr., lb	.08 –	.09
Para-cresol, bbl., lb	.41 –	
Para-nitraniline, bbl., lb	.47 –	.49
Phenol, USP, drums, lb	.10 –	.11
Picric acid, bbl., lb	.35 –	.40
Pyridine, dr., gal	1.55 –	1.60
Resorcinol, tech., kegs, lb	.65 –	.70
Salicylic acid, tech., bbl., lb	.26 –	.33
Solvent naphtha, w.w., tanks, gal.	.26 –	
Toluidin, bbl., lb	.96 –	.98
Toluol, drums, works, gal	.32 –	
Xylol, com., tanks, gal	.25 –	
MISCELLANEOUS		
Casein, tech., bbl., lb	$0.21 –	$0.24
Dry colors		
Carbon gas, black (wks.), lb	.0335–	.20
Prussian blue, bbl., lb	.36 –	.37
Ultramarine blue, bbl., lb	.11 –	.26
Chrome green, bbl., lb	.23 –	.24
Carmine, red, tins, lb	4.60 –	4.75
Para toner, lb	.75 –	.80
Vermilion, English, bbl., lb	2.50 –	2.60
Chrome, yellow, C.P., bbl., lb	.16 –	.17
Gum copal, Congo, bags, lb	.09 –	.24
Manila, bags, lb	.09 –	.13
Damar, Batavia, cases, lb	.10 –	.22
Kauri, cases, lb	.18 –	.60
Magnesite, calc, ton	64.00 –	
Pumice stone, lump, bbl., lb	.05 –	.07
Rosin, H., 100 lb	7.43 –	
Shellac, orange, fine, bags, lb	.39 –	
Bleached, bonedry, bags, lb	.29 –	
T. N. bags, lb	.31 –	
Turpentine, gal	.89 –	

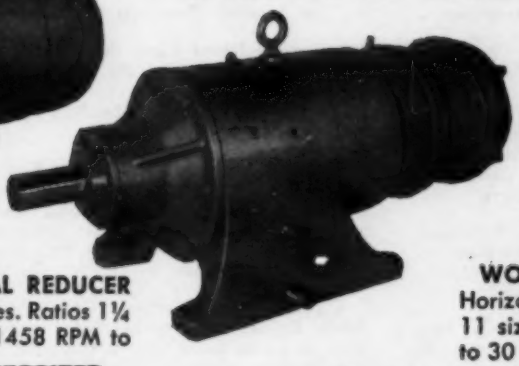
Established 1888

D.O.James

MOTORIZED

SPEED REDUCERS

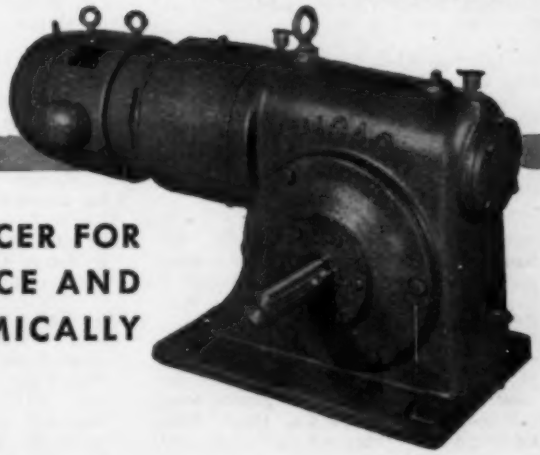
MOTORIZED HELICAL REDUCER
Horizontal drive. 8 sizes. Ratios 1¼ to 9:1. ¾ to 50 HP. 1458 RPM to 128 RPM.



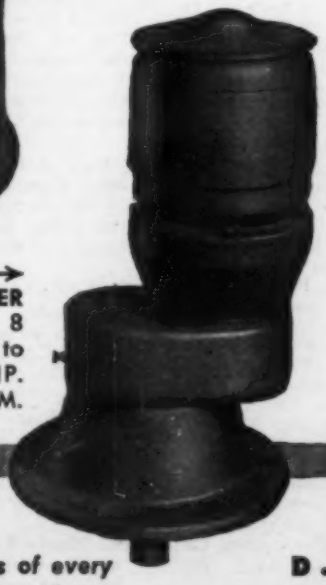
MOTORIZED PLANETARY REDUCER
Horizontal drive. 35 sizes. Ratios 10 to 1200:1. ¾ to 75 HP. 172 RPM to 74 RPM.

MOTORIZED WORM GEAR REDUCER
Horizontal and vertical drive. 11 sizes. Ratios 6 to 65:1. ⅛ to 30 HP. 310 RPM to 25 RPM.

MOTORIZED PLANETARY REDUCER
Vertical drive. 35 sizes. Ratios 10 to 1200:1. ¾ to 75 H.P. ← 172 RPM to 74 RPM.



THE IDEAL GEAR REDUCER FOR LIMITED FLOOR SPACE AND IS OPERATED ECONOMICALLY



MOTORIZED → HELICAL REDUCER
Vertical drive. 8 sizes. Ratios 1¼ to 9:1. ¾ to 50 HP. 1458 to 128 RPM.

The design and manufacture of D.O.James motorized reducers embodies all the high quality of construction of our standard gear reducers. In addition to this in-built quality you have many advantages — such as compactness, lower cost and elimination of separate supports, thereby saving valuable floor space. D.O.James Motorized Reducers are manufactured to drive up, down, horizontally or at an angle.

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Over 57 years makers of every type of gear and gear reducer.

D. O. JAMES MANUFACTURING CO.
1140 W. MONROE STREET, CHICAGO, ILL.

NEW CONSTRUCTION

	Current Projects		Cumulative 1945	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$250,000	$790,000	$3,210,000	$16,429,000
Middle Atlantic	40,000	8,850,000	5,372,000	26,626,000
South		5,543,000	19,338,000	27,882,000
Middle West	1,100,000	1,545,000	11,749,000	27,630,000
West of Mississippi	21,200,000	14,400,000	79,672,000	90,334,000
Far West		2,900,000	4,745,000	10,820,000
Canada			8,769,000	2,681,000
Total	$22,590,000	$34,028,000	$132,855,000	$202,402,000

PROPOSED WORK

Ind., Gary—Posture Products Corp., 6 West 6th St., manufacturer of plastics, has had plans prepared by Beine, Hall & Curran, Archts., 607 Broadway, for the construction of a 1 story plant. Estimated cost $100,000.

Mass., Indian Orchard—Monsanto Chemical Co., Monsanto Ave., is having plans prepared for the construction of a 1 and 2 story factory and power plant addition. Estimated cost $250,000

O., Toledo—Pure Oil Co., Bay Shore and Otter Creek Rds., plans to construct a petroleum coke plant. Lummus Co., 420 Lexington Ave., New York, N. Y., Engr. Estimated cost $1,000,000.

Pa., Springdale—Pittsburgh Plate Glass Co., 2026 Grant Bldg., Pittsburgh, has acquired a 15 acre site and plans to construct a paint factory. Hunting, Davis & Dunnells, Century Bldg., Pittsburgh, Cons. Engrs.

Tex., Beaumont—Pure Oil Co., Beaumont, and Esperson Bldg., Houston, plans to enlarge its refinery. Estimated cost $6,000,000.

Tex., Carthage—Hydrocarbon Research, Inc., c/o P. C. Keith, Peapack, N. J., plans to construct a synthetic oil products plant. Estimated cost $15,000,000.

Tex., Houston—Gulf Portland Cement Co., Ship Channel, plans to construct a cement manufacturing plant. Estimated cost $200,000.

CONTRACTS AWARDED

Ala., Mobile—Linde Air Products Co., 205 East 42nd St., New York, N. Y., has awarded the contract for an acetylene plant here to Evans Construction Co., Merchant Natl. Life Bldg., Mobile, at $42,500.

Ala., Mobile—National Gypsum Co., Baker St., has awarded the contract for design and construction of an addition to gypsum board mill to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $3,000,000.

Calif., Salida—Shell Chemical Co., 100 Bush St., San Francisco, has awarded the contract for the construction of an agricultural laboratory to Parker, Steffens & Pearce, South Park St., San Francisco. Estimated cost $350,000.

Calif., Torrance—Shell Union Oil Co., Shell Oil Bldg., Los Angeles, has awarded the contract for the construction of an Isoprene plant adjacent to its present Butadiene plant to Stone & Webster, 601 West 5th St., Los Angeles. Estimated cost $2,000,000.

Calif., Torrance—United States Rubber Co., Div. Rubber Reserve Co., 5675 Anaheim-Telegraph Rd., Los Angeles, has awarded the contract for the construction of a synthetic latex production unit at its plant to Bechtel-McCone Corp., 816 W. 5th St., Los Angeles. Estimated cost $500,000.

Calif., Vernon—Pioneer Div. of Flintkote Co., 5500 South Alameda St., has awarded the contract for the construction of a warehouse to Buttress & McClellan, 1013 East 8th St., Los Angeles. Estimated cost $50,000.

Colo., Denver—Inland Paper Box Co., 1631 Waxell St., has awarded the contract for the construction of a 1 story, 240x380 ft. factory to N. G. Petry, Denham Bldg. Estimated cost $350,000.

Ga., Savannah—Union Bag & Paper Corp., Lathrop Ave., has awarded the contract for the construction of a pulp washing plant and power facilities, to the Rust Engineering Co., Clark Bldg., Pittsburgh, Pa. Estimated cost $2,000,000.

Ill., Chicago—Liquid Carbonic Corp., 3100 South Kedzie Ave., has awarded the contract for a glass house, etc., to Kaiser-Ducett Co., 80 East Jackson Blvd., Chicago. Estimated cost $100,000.

Ill., East St. Louis—Geo. A. Nepham Corp., 2001 Lynch Ave., has awarded the contract for a laboratory building to E. A. Brunson Construction Co., 4052 Forest Park Blvd., St. Louis.

Ill., Mattoon—Kuehne Mfg. Co., Mattoon, has awarded the contract for a 1 story, 70x250 ft. addition and a 1 story, 130x600 ft. glass manufacturing plants, to Hougland & Farrier Co., 2021 Wabash Ave. Estimated cost $600,000.

Kan., Kansas City—Owens-Corning Fiberglas Corp., Nicholas Bldg., Toledo, O., has awarded the contract for altering Fairfax Dist. plant at Fairfax Airport, to Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost between $4,000,000 and $8,000,000 with equipment.

La., Baton Rouge—Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y., has awarded the contract for a petroleum research laboratory to John W. Harris Associates, Inc., 30 Rockefeller Plaza, New York, N. Y. Estimated cost $500,000.

Me., Great Works—Penobscot Chemical Fibre Co., Great Works, has awarded the contract for the construction of a plant unit to Morton C. Tuttle, 862 Park Sq. Bldg., Boston, Mass. Estimated cost $40,000.

Md., Baltimore—National Industrial Chemical Corp., Curtis Bay, has awarded the contract for boiler house extension and feed water treatment plant to Dravo Corp., Neville Island, Pittsburgh, Pa. Estimated cost $100,000.

Mass., North Rochester—Spaulding Fibre Co., Inc., North Rochester, has awarded the contract for a fibre board mill and boiler house addition to Harty Blaney Construction Co., 25 Huntington Ave., Boston, Mass. Estimated cost $750,000.

Minn., Minneapolis—Archer-Daniels Midland Co., linseed oil manufacturers, 600 Roanoke Bldg., has awarded the contract for a 4 story addition to its elevator plant to be used as a grain dryer, to Fegles Construction Co., 711 Wesley Temple Bldg. Estimated cost $100,000.

Mo., Kansas City—Owens-Corning Fiberglas Corp., Nicholas Bldg., Toledo, O., has awarded the contract for altering Blue Valley plant to Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost including equipment $7,000,000.

N. J., Clifton—Shulton, Inc., 630 5th Ave., New York, N. Y., has awarded the contract for design and construction of cosmetic manufacturing plant to Ford, Bacon & Davis, 39 Broadway, New York, N. Y. Estimated cost $1,000,000.

N. J., Kearney—(br. Arlington)—Congoleum-Nairn, Inc., 295 Fifth Ave., New York, N. Y., has awarded the contract for several additions to its plant to Turner Construction Co., 420 Lexington Ave., New York 17, N. Y. Estimated cost including equipment will exceed $2,000,000.

N. J., Linden—Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y., has awarded the contract for a petroleum research laboratory to George A. Fuller Co., 597 Madison Ave., New York, N. Y. Estimated cost $5,000,000.

N. Y., Rensselaer—General Aniline Works, Div. of General Aniline & Film Corp., 230 Park Ave., New York, N. Y., has awarded the contract for the construction of a 2 and 3 story wash house to F. H. McGraw & Co., 51 East 42nd St., New York. Estimated cost $750,000.

O., Avon—B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, has awarded the contract for the construction of a pilot plant to John Gill & Son, Bukley Bldg., Cleveland. Estimated cost $600,000.

O., Cleveland—Harshaw Chemical Co., 1000 Harvard Ave., S. E., has awarded the contract for an addition to its plant to H. L. Vokes Co., Cleveland. Estimated cost $205,000.

Tex., Carthage—Carthage Gasoline Plant has awarded the contract for the construction of a laboratory to Stearns-Rogers Manufacturing Co., Union National Bldg., Houston. Estimated cost $50,000.

Tex., Haney—Rogers Lacey, Longview, Tex., will construct a refinery using own labor. Estimated cost $900,000.